ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

THE MAGAZINE OF
THE ORTHOPAEDIC SECTION, APTA

APTA
American Physical Therapy Association

VOL. 14, NO. 2 2002

ORTHOPAEDIC SECTION
AMERICAN PHYSICAL THERAPY ASSOCIATION
PRACTICE EDUCATION RESEARCH

Special Topic Issue
Featuring...

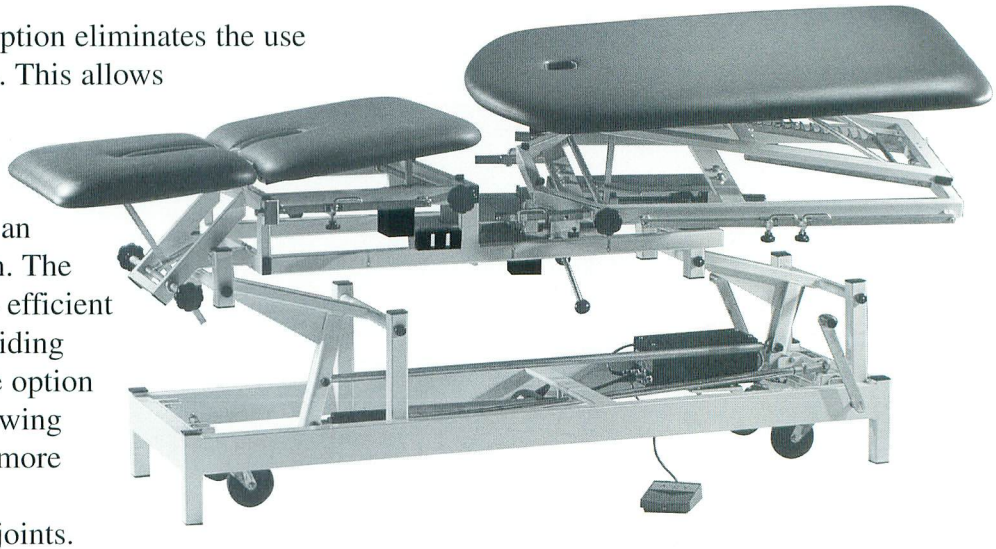
PASIG
PERFORMING ARTS SPECIAL INTEREST GROUP

THE ACCEPTED STANDARD OF PERFORMANCE

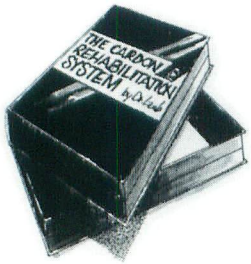
The Cardon Mobilization Table

Going Beyond The Third Dimension

A newly available patented option eliminates the use of flexion and rotation levers. This allows the therapist to perform advanced manual therapy techniques with complete confidence and comfort with an ergonomically friendly design. The unique design provides more efficient and smooth setup while providing superior patient comfort. The option enhances patient care by allowing unsurpassed opportunity for more preciseness of treatment and monitoring of segments and joints.



See for yourself these outstanding features:
Accurate localization of the vertebral segment; Precision and versatility of technique;
Absolute control of the mobilization forces; Excellent stability for manipulation.



The design and concepts make this the best mobilization table manufactured today"

Professor Freddy Kaltenborn
Author, Int'l Lecturer in Manual Therapy

The various sections have minimum flex allowing very accurate application of specific manual therapy techniques"

Olaf Evjenth
Author, Int'l Lecturer in Manual Therapy

YES! I would like to preview the Cardon Mobilization Table.

Please rush your 15 minute VHS video:

Name: _____ Title: _____

Clinic/Institution: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Telephone: _____ Signature: _____

Rehab

CARDON REHABILITATION PRODUCTS, INC.™
6311 Inducon Corporate Drive, Unit 14
Sanborn, New York 14132
Telephone: 1-800-944-7868 • Fax: 716-297-0411

Rehab®

CARDON REHABILITATION PRODUCTS, INC.™
6311 Inducon Corporate Drive, Unit 14
Sanborn, New York 14132
Telephone: 1-800-944-7868 • Fax: 716-297-0411

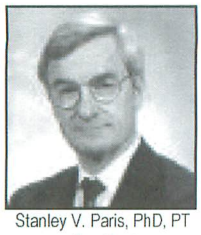
Register Online at www.usa.edu or Call today at 1-800-241-1027!

UNIVERSITY OF ST. AUGUSTINE

FOR HEALTH SCIENCES

Manual Therapy and Orthopaedic Seminars
2002 Seminar Calendar

CONTINUING EDUCATION SEMINARS



Stanley V. Paris, PhD, PT
President

S1 - Introduction to Spinal Evaluation & Manipulation
40 Hours, 4.0 CEUs (No Prerequisite)
$695

Santa Ana, CA	Yack	May 3 - 7
Atlanta, GA	Smith	May 4 - 8
Harrisburg, PA	Viti	Jun 5 -9
New Orleans, LA	Lonneman	Jun 5 - 9
Oklahoma City, OK	Smith	Jun 8 - 12
Indianapolis, IN	Viti	Jul 10 - 14
Pittsburgh, PA	Lonneman	Jul 17 - 21
Salt Lake City, UT	Yack	Jul 17 - 21
Virginia Beach, VA	Olson	Jul 17 - 21
Boise, ID	Smith	Jul 26 - 30
Concord, NH	Lonneman	Aug 7 - 11
St. Augustine, FL	Paris/Viti	Aug 14 - 18
Houston, TX	Yack	Aug 21 - 25
Omaha, NE	Smith	Aug 21 - 25
Sacramento, CA	Yack	Sep 6 - 10
Coral Springs, FL	Yack	Sep 18 - 22
St. Augustine, FL	Paris/Viti	Sep 25 - 29
Dallas, TX	Viti	Oct 2 - 6
Reykjavik, Iceland	Yack	Oct 2 - 6
St. Augustine, FL	Paris/Viti	Oct 16-20
Las Vegas, NV	Yack	Oct 18 - 22
Toledo, OH	Olson	Nov 6 - 10
Baltimore, MD	Smith	Nov 8 - 12
St. Augustine, FL	Paris/Viti	Dec 4 - 8
Colorado Springs, CO	Yack	Dec 6 - 10

E1 - Extremity Evaluation and Manipulation
36 Hours, 3.6 CEUs (No Prerequisite)
Also available to OTs
$585

St. Augustine, FL	Patla	May 16 - 19
Baltimore, MD	Busby	May 16 - 19
Chicago, IL	Busby	May 23 - 26
Alcoa, TN	Turner	Jun 13 - 16
DesMoines, IA	Turner	Jul 25 - 28
Atlanta, GA	Busby	Aug 1 - 4
New Orleans, LA	Busby	Aug 8 - 11
Troy, NY	Turner	Aug 15 - 18
Chico, CA	Busby	Aug 22 - 25
Las Vegas, NV	Turner	Sep 12 - 15
St. Augustine, FL	Patla	Sep 19 - 22
Washington, DC	Busby	Oct 17 - 20
Indianapolis, IN	Turner	Oct 24 - 27
St. Augustine, FL	Patla	Nov 7 - 10
Harrisburg, PA	TBA	Nov 14 - 17
Oklahoma City, OK	Turner	Nov 14 - 17
Colorado Springs, CO	Turner	Dec 5 - 8

*Specifically designed to respect the Sabbath.

S2 - Advanced Evaluation & Manipulation of Pelvis, Lumbar & Thoracic Spine
27 Hours, 2.7 CEUs (Prerequisite S1)
$450

Harrisburg, PA	Irwin	May 17 - 19
*St. Augustine, FL	Irwin	Jun 2 - 4
Washington, DC	Yack	Jun 21 - 23
Colorado Springs, CO	Irwin	Jul 19 - 21
Cincinnati, OH	Irwin	Aug 1 - 4
Pittsburgh, PA	Irwin	Sep 27 - 29
St. Augustine, FL	Yack	Sep 27 - 29
DesMoines, IA	Irwin	Oct 18 - 20
Milwaukee, WI	Yack	Nov 8 - 10
Santa Ana, CA	Yack	Nov 15 - 17
*Toledo, OH	Yack	Dec 15 - 17

MF1 - Myofascial Manipulation
24 Hours, 2.4 CEUs (No Prerequisite)
$450

Sarasota, FL	Grodin	May 3 - 5
LaJolla, CA	Cantu	May 17 - 19
Houston, TX	Cantu	Jun 21 - 23
Las Vegas, NV	Grodin	Jun 28 - 30
Baltimore, MD	Cantu	Jul 12 - 14
St. Augustine, FL	Cantu	Aug 9 - 11
Washington, DC	Grodin	Aug 23 - 25
*Atlanta, GA	Grodin	Sep 25 - 27
Denver, CO	Cantu	Oct 25 - 27
Chicago, IL	Cantu	Nov 1 - 3

E2 - Extremity Integration
24 Hours, 2.4 CEUs (Prerequisite E1)
(Prerequisite for Manual Therapy Certification in 2001)
$450

Houston, TX	Patla	Apr 5 - 7
Jacksonville, FL	Patla	Apr 26 - 28
Washington, DC	Varela	May 10 - 12
St. Augustine, FL	Patla	Jun 14 - 16
Chicago, IL	Varela	Jun 28 - 30
Beverly, MA	Patla	Sep 27 - 29
Harrisburg, PA	Varela	Oct 4 - 6
St. Augustine, FL	Patla	Oct 25 - 27

Spinal Instability - Whole Spine Stabilization
7 Hours, .7 CEUs (No Prerequisite) Also available to OT's, PTA's & COTA's
$150

New York City, NY	Paris	Aug 22
Beverly, MA	Paris	Aug 24
Loveland, CO	Paris	Sep 19
LaJolla, CA	Paris	Sep 21

S3 - Advanced Evaluation & Manipulation of the Cranio Facial, Cervical & Upper Thoracic Spine
32 Hours, 3.2 CEUs (Prerequisite S1)
$650

St. Augustine, FL	Paris/Rot	May 9 - 12
St. Augustine, FL	Paris/Rot	Jun 20 - 23
Denver, CO	Rot	Jul 18 - 21
*Milwaukee, WI	Rot	Aug 11 - 14
Cincinnati, OH	Smith	Aug 16 - 19
Baltimore, MD	Smith	Sep 14 - 17
Chicago, IL	Rot	Sep 26 - 29
St. Augustine, FL	Paris/Rot	Oct 10 - 13
Atlanta, GA	Smith	Oct 11 - 14
Springfield, MO	Rot	Oct 25 - 28
Las Vegas, NV	Rot	Nov 14 - 17
Pittsburgh, PA	Rot	Dec 12 - 15
Orlando, FL	Smith	Dec 14 - 17

S4 - Functional Analysis & Management of Lumbo-Pelvic-Hip Complex
16 Hours, 1.6 CEUs (Prerequisite S1)
$420

Beverly, MA	Nyberg	Jun 8 - 9
*St. Augustine, FL	Nyberg	Jun 30 - Jul 1
Harrisburg, PA	Nyberg	Aug 3 - 4
Chicago, IL	Nyberg	Aug 17 - 18
Atlanta, GA	Nyberg	Sept 14 - 15
New York City, NY	Nyberg	Oct 26 - 27

CERTIFICATION WEEK Preparation and Examination
36 Hours, 3.2 CEUs
(Prerequisites for each Certification vary)
$750

St. Augustine, FL		May 20 - 25
St. Augustine, FL		Sep 30 - Oct 5

Intermediate Cranio-Facial
20 Hours, 2.0 CEUs (Prerequisite Basic Cranio-Facial available Online)
$425

Chicago, IL	Rocabado	Oct 19 - 21

Advanced Cranio-Facial
20 Hours, 2.0 CEUs (Prerequisite Intermediate Cranio-Facial)
$425

Chicago, IL	Rocabado	Oct 22 - 24

University of St. Augustine
For Health Sciences
1 University Boulevard
St. Augustine, FL 32086-5783
Registration: 800-241-1027
FAX: 904-826-0085

Name: _____
___PT
Address: _____
City: _____
State: _____ Zip: _____
Email: _____
Home: (____) ____-____
Work: (____) ____-____
FAX: (____) ____-____
Please register me for:
Seminars: _____
Locations: _____
Dates: _____

Prerequisite information:
Seminar: _____
Location/Date: _____

Is this your first seminar with the University? Yes____ No ____

A $50 non-refundable deposit must accompany registration form. A $200 non-refundable, non-transferable deposit is required for Certification. Balance is due 30 days prior to start date of the seminar. Balance can be transferred or refunded with 2 week written notice. Notice received after that time subject to only 50% refund. No refunds or transfers will be issued after the seminar begins.

METHOD OF PAYMENT
____Check or Money Order enclosed
Please make payable to: University of St. Augustine
Charge my: VISA MasterCard
___ ___
Card # _____
Exp. date: ___/___
Amount: $_____
Signature: _____

Team Discount - Two or more persons from the same facility registering for the same seminar at the same time, receive a 10% discount at the time of registration.
(Advanced notice and full payment required, does not apply after the first day of a seminar.)

Multiple Seminar Discount - Register and pay in full for two or more seminars at the same time and receive a 10% discount.
(May not be combined with any other discounts or previous registrations.) O-APTA 4/02

Advance Your Opportunities by Investing in Your Education
Earn Your Transitional DPT

Convenient Distance Education Format with Online Courses
Can Earn a Certification and a DPT Degree
Clinically Relevant
Available to PT's with Bachelor's or Master's Degree

Call 800/241-1027 or Visit our Website www.usa.edu

Seminar dates, locations, and tuition are subject to change, please call before making any non-refundable reservations.

ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

TABLE OF CONTENTS

MISSION

The mission of Orthopaedic Section of the American Physical Therapy Association is to be the leading advocate and resource for the practice of orthopaedic physical therapy. The Section will serve its members by fostering high quality patient care and promoting professional growth through:

- Advancement of education and clinical practice,
- Facilitation of quality research, and
- Professional development of members.

PUBLICATION STAFF

MANAGING EDITOR & ADVERTISING
Sharon L. Klinski
Orthopaedic Section, APTA
2920 East Ave. So., Suite 200
La Crosse, Wisconsin 54601
800-444-3982 x 202
608-788-3965 FAX
Email: sklinski@centurytel.net

Orthopaedic Physical Therapy Practice (ISSN 1532-0871) is the official magazine of the Orthopaedic Section, APTA, Inc. Copyright 2002 by the Orthopaedic Section/APTA. Nonmember subscriptions are available for $30 per year (4 issues). Opinions expressed by the authors are their own and do not necessarily reflect the views of the Orthopaedic Section. The editor reserves the right to edit manuscripts as necessary for publication. All requests for change of address should be directed to the La Crosse Office.

All advertisements which appear in or accompany *Orthopaedic Physical Therapy Practice* are accepted on the basis of conformation to ethical physical therapy standards, but acceptance does not imply endorsement by the Orthopaedic Section.

Orthopaedic Practice is indexed by Cumulative Index to Nursing & Allied Health Literature (CINAHL).

Publication Title: *Orthopaedic Physical Therapy Practice* **Statement of Frequency:** Quarterly; April, June, August, and December
Authorized Organization's Name and Address: Orthopaedic Section, APTA, Inc., 2920 East Avenue South, Suite 200, La Crosse, WI 54601-7202

Orthopaedic Section Directory

■ OFFICERS

President:	Vice President:	Treasurer:	Director:	Director:
Michael T. Cibulka, PT, MHS, OCS Jefferson County Rehab & Sports Clinic 1330 YMCA Drive, Suite 1200 Festus, MO 63028 (636) 937-7677 (Office) (636) 931-8808 (FAX) jcrehab@jcn.net Term: 2001 - 2004	**Lola Rosenbaum, PT, MHS, OCS** 118 Shadowood Dr. Warner Robins, GA 31088 (478) 918-0415 (478) 918-0325 (FAX) lolarose5@cox.net Term: 2001 - 2004	**Joe Godges, DPT, MA, OCS** Kaiser PT Residency & Fellowships 6107 West 75th Place Los Angeles, CA 90045-1633 (310) 215-3664 (Office) (310) 215-0780 (FAX) godges@msn.com Term: 2002-2005	**Joe Farrell, PT, MS** Redwood Orthopaedic PT, Inc. 20211 Patio Drive, Suite 205 Castro Valley, CA 94546 (510) 537-3991 (Office) (510) 537-2997 (FAX) jfarrellropt@sbcglobal.net Term: 2000-2003	**Gary Smith, PT, PhD** St. Lukes Rehabilitation Institute 711 South Cowley Spokane, WA 99202 (509) 220-5923 (Office) (509) 473-5535 (FAX) smithgj@st-lukes.org Term: 2002-2005

■ CHAIRS

MEMBERSHIP
Chair:
Michael Wooden, PT, MS, OCS
4770 Forestglade Court
Stonemountain, GA 30087
(770) 496-1693 (Office/FAX)
michael.wooden@physio.strykercorp.com

Members: *Brent Anderson, Wanda Adkins, Mari Bosworth, Julia Chevan, John Childs, Matthew Crill, Michael Knox, Mike Koford, Robert Rhodes, Shaira Rose, Byron Russell, Kathleen Shilue, Geri Ann Sokell, Terry Trundle, Janey Wilding, Christopher Wise*

EDUCATION PROGRAM
Chair:
Paul Howard, PT, PhD, CertMDT
Thomas Jefferson University
Ste 830, Edison Bldg. 130 S. 9th St
Philadelphia, PA 19107
(215) 503-5011 (Office)
(215) 503-3499 (FAX)
paul.howard@mail.tju.edu

Vice Chair: Ellen Hamilton, PT, OCS

Members: *Mark Cornwall, Dee Daley, Bob Duvall, Kristinn Heindrichs, Joe Kleinkort, Lynn Medoff, Chris Powers, Gary Shankman, Patty Zorn*

HOME STUDY COURSE
Editor:
Mary Ann Wilmarth, DPT, MS, OCS, MTC, CertMDT
10 Nollet Dr
Andover, MA 01810-6312
(978) 682-8802
mwilmarth@attbi.com

Managing Editor:
Kathy Olson
kmolson@centurytel.net
(See Office Personnel)

ORTHOPAEDIC PRACTICE
Editor:
Susan A. Appling, PT, MS, OCS
University of Tennessee
822 Beale St., Ste. 337
Memphis, TN 38163
(901) 448-5888
(901) 448-7545 (FAX)
sappling@utmem.edu

Managing Editor: Sharon Klinski
sklinski@centurytel.net
(See Office Personnel)

RESEARCH
Chair:
James Irrgang, PT, PhD, ATC
University of Pittsburgh
Department of Physical Therapy
Sennett at Atwood Streets
Pittsburgh, PA 15260
(412) 432-1237 (Office)
(412) 432-1454 (FAX)
irrgangjj@msx.upmc.edu

Members: *Nancy Byl, Paula Ludewig, Lori Michen*

ORTHOPAEDIC SPECIALTY COUNCIL
Chair:
Robert Johnson, PT, MS, OCS
406 N Brainerd
LaGrange, IL 60526
(708) 579-0423
bobjcinn@aol.com

Members: *Col. Nancy Henderson, Michael T. Cibulka*

PRACTICE
Chair:
Stephen C.F. McDavitt, PT, MS
Saco Bay Orthopaedic and
Sports Physical Therapy PA
100 Foden Road, Suite 103 West
South Portland, ME 04106-4246
(207) 772-2625 (Office)
(207) 879-4246 (FAX)
scfm@mcdavittpt.com

Members: *Bill Boissonnault, Joe Farrell, Helene Fearon, Aimee Klein, Gary Smith, Richard Smith*

PUBLIC RELATIONS
Chair:
Terry Randall, PT, MS, OCS, ATC
Somerset Physical Therapy
353 Bogle St.
Somerset, KY 42503
(606) 679-1761 (Office)
(606) 678-0971 (FAX)
spts@hyperaction.net

Members: *Michael Tollan, Rick Watson, Pat Zerr*

FINANCE
Chair:
Joe Godges, DPT, MA, OCS
(See Treasurer)

Members: *Steve Clark, Stuart Platt, Pam White*

AWARDS
Chair:
Lola Rosenbaum, PT, MHS, OCS
(See Vice President)

Members: *Mari Bosworth, Jerome Danoff, Nicholas Quarrier, Kim Schoensee*

JOSPT
Editor-in-Chief:
Guy Simoneau, PT, PhD, ATC
Marquette University
P.O. Box 1881
Milwaukee, WI 53201-1881
(414) 288-3380 (Office)
(414) 288-5987 (FAX)
guy.simoneau@marquette.edu

Executive Director:
Tina Vogel
tinavogel@jospt.org

NOMINATIONS
Chair:
William H. O'Grady, PT, DPT, OCS, FAAOMPT
1214 Starling Street, Apt. #1
Steilacoom, WA 98388-2040
(253) 846-8918 (Office)
(253) 983-9411 (FAX)
ogrady@tacoma.net

Members: *Tim Flynn, Susan Michlovitz*

SPECIAL INTEREST GROUPS

OCCUPATIONAL HEALTH SIG
Deborah Lechner, PT - President
FOOT AND ANKLE SIG
Steve Reischl, PT, DPT, OCS - President
PERFORMING ARTS SIG
Jeff Stenbach, PT - President
PAIN MANAGEMENT SIG
Joe Kleinkort, PT, MA, PhD, CIE - President
ANIMAL PT SIG
Cheryl Riegger-Krugh, PT - President

APTA BOARD LIAISON
Randy Roesch, PT, MBA
randyroesch@apta.org

Orthopaedic Section Website:
www.orthopt.org
Bulletin Board feature also included. Check it out soon!

■ OFFICE PERSONNEL

Orthopaedic Section, APTA, Inc., 2920 East Avenue South, Ste. 200, La Crosse, WI 54601-7202, (800) 444-3982 (Office), (608) 788-3965 (FAX)

Terri DeFlorian, Executive Director	*x 204*	*tdeflorian@centurytel.net*	*Stefanie Snyder, Program Coordinator*	*x 205*	*ssnyder@centurytel.net*
Tara Fredrickson, Executive Associate	*x 203*	*tfred@centurytel.net*	*Linda Calkins, Project Assistant*	*x 215*	*lcalkins@centurytel.net*
Sharon Klinski, Managing Editor J/N	*x 202*	*sklinski@centurytel.net*	*Jessica Deal, Receptionist*	*x 201*	*jdeal@centurytel.net*
Kathy Olson, Managing Editor HSC	*x 213*	*kmolson@centurytel.net*	*Darlene Aberg, HSC Registration Coord.*	*x 216*	*daberg@centurytel.net*

Editor's Message

"Shuffle-ball-change, shuffle-ball-change, shuffle-ball-change, step, step"

Did you ever take dance lessons, or maybe have children who did? If so, you will likely understand the title. It describes a series of dance steps that are common in tap dancing. While this issue of *Orthopaedic Physical Therapy Practice* does not include an article on tap dancing, the entire issue is dedicated to performing arts physical therapy.

When was the last time you went to the symphony or opera? While enjoying the performance, did you consider the training (particularly the physical component) involved for the musician or singer to reach his or her particular skill level? Aside from enjoying the beautiful music, did you wonder if the violinist had neck pain after a performance, or if the horn player had scapular pain? Probably not. While most of us do appreciate good music and leave a performance reflecting on the beauty of it, I suspect most people don't consider the training and dedication it takes to be a performing artist. Training of these artists must include the technical and artistic components of the art form, but also the physical components of muscular strength and coordination, balance, and endurance, as well as postural education.

Do you ever use the phrase "tighten your stomach and tuck your buttocks," when instructing a patient/client in posture correction? Since a large percentage of my practice includes working with patients with spinal dysfunction, I find myself using those words quite often. Every time I say "tighten your stomach and tuck your buttocks," I remember my former dance teacher Mrs. Billie Buck. She was a very gracious southern lady who taught many young girls in my hometown to dance. Although I didn't realize it at the time, she also taught us about posture, flexibility, strength, and coordination.

Tap dancing was my favorite part, although I also took ballet lessons. I think I liked tap best because I was able to perform that type of dance with good technique. The problem with ballet was that I couldn't do all those movements quite so well. Not only did I have difficulty being able to turn out enough in first position; I also had trouble with pliés. It seems that I just couldn't do a full plié without lifting my heels off the ground. Any good ballerina knows that lifting your heels with a plié is very poor technique. After I became a physical therapist, I was finally able to figure out why I couldn't do a plié very well. I didn't have the flexibility I needed to perform the technique. Too bad I didn't have a PT around to show me how to stretch my gastrocsoleus and hip muscles. If so, maybe I could have gone to Juilliard, or been a dancer on Broadway. For those of you who know me, you know even the best physical therapist couldn't have made me a professional dancer! Enough of that old dream.

If you didn't take dance lessons, maybe you took piano or violin lessons. Maybe you were in the school band, a symphony, or were on the dance team. Generally, we don't think of these activities as sport, but rather, art. We think of the beauty of the music or performance, but often don't consider the physical demands the art requires of the artist. It takes considerable endurance to perform as a professional dancer, figure skater, singer, or musician. In addition, these artists are often in constrained postures for prolonged periods of time. We know what working in constrained postures will do to an individual over time—but often we think of the plumber, office worker, or warehouse employee who works in a constrained posture. We don't necessarily think of the artist. These persons have the same types of overuse injuries that our other clients do, but their work requires different demands. In addition, working with this population of clients requires special skills on the part of the therapist. All of us have the fundamental skills needed to work with the performing artist. However, it takes more than entry-level education to be particularly skilled with this population.

Training is the key for any type of performance—be it dancing in *The Nutcracker,* playing the flute in the symphony, or pitching a baseball. That's right, I said pitching a baseball. Typically, we do not put artists and athletes in the same frame of reference, but the dedication—and the magnitude of physical requirements—is very similar. Both types of activities require physical prowess and technical skill. Both types require frequent practice and regular instruction. They require years of dedication to reach the highest levels of performance. They require efforts to prevent injury and then aggressive management if injury does occur so that the performer can return to his or her highest level of function as soon as possible. Just as we try to get the injured employee back to work as quick as possible with "functional rehab," so too do we need to get the performing artist back to work performing. When providing physical therapy for these artists, it may be helpful for us novices to consider the artist much like the athlete.

Along those lines, we must continue to learn to communicate with the artist who is our client. Just as basketball and football have terms unique to the sport, so too does dance, music, or any other area of performing arts. When working with this population of clients, it is important to understand and use terminology with which they are familiar. If you work with a basketball player who has back pain, you may teach her about neutral spine posture and *hip hinging* techniques by using the example of the typical defensive stance position. With a football player, you have to know the physical demands required by his particular position so that you can design a specific rehab program. Likewise, you have to know what first position and fifth position are (as well as the positions in between) in order to work with a dancer recovering from injury. The physical therapist and physical therapist assistant who choose to work with performing artists must learn both terminology and technique. Understanding the culture of the particular area of performing arts is also very important in working with this population of clients, as that culture may have a huge impact on compliance and outcome.

This issue of *OP* is all about physical therapy and the performing arts. When I hear that phrase, my first thought is of the dancer. The dancer must have tremendous strength, flexibility and endurance, as well as terrific motor control. So, we have 4 articles in this issue related to dance. These include clinical articles, information on dance science, and dance medicine and research. However, we did not forget that dance is not the only

(continued on page 10)

Guest Editorial

The members of the PASIG (Performing Arts Special Interest Group) are proud to have been asked to participate in this special issue of *Orthopaedic Physical Therapy Practice*. As an emerging special practice area within physical therapy, treatment of the performing artist offers a host of opportunities and has proven to be quite diverse. Our membership continues to grow and includes physical therapists and physical therapist assistants that work with dancers, musicians, gymnasts, circus performers, actors, producers, and figure skaters. Some of us are generalists and see the occasional injured dancer or music student, while others of us are quite specialized and are involved with local, national, and international ballet corps, symphonies, or dance and music schools. Providing traditional office treatment, traveling with an on-tour show or coordinating backstage on-site services immerses many of our members in a front seat involvement with the arts. A few of our members teach kinesiology of dance classes to dance students and dance educators, as well as those who offer symposiums on injury prevention and performance enhancement to members of orchestras or chamber groups. We are currently undergoing the rigors of a practice analysis, funded by a grant through the Orthopaedic Section, which will enable us to further determine the skills that define a performing arts physical therapist. This process will hopefully guide future education and the formation of mentorship, residency, and fellowship programs in this area.

We hope you'll enjoy a glimpse of what we do within our profession that perhaps makes us a bit unique. We've tried to compile a varied line-up of authors from different parts of the performing arts physical therapy spectrum. Some of the articles are more advanced and others are more introductory—in other words, something for all. Perhaps you will find something here that intrigues you or that you believe you would like to do as well. We welcome your questions and comments, for, as with all physical therapy literature, an open sharing of ideas helps us all grow personally and professionally. Membership in the PASIG is free and open to all Orthopaedic Section members. You may access our special interest group website at www.orthopt.org. Once again, enjoy this special topic issue and thank you, *OPTP*, for the opportunity to showcase a little of what, I believe, makes us special.

Jeffrey T. Stenback, PT, OCS
President, Performing Arts Special Interest Group

President's Message

Performing Orthopaedic Physical Therapy in D Minor

This special issue of *OP* is dedicated to Performing Arts Physical Therapy. When I first think of performing arts physical therapy I think of the cacophony of cymbals crashing, the beating of the drums, and of dancers flying gracefully in the air. All right, I am not really a performing arts physical therapist. How could you ever guess? I do know one thing, however, and that is that in most of the performing arts, it takes a team working together to pull off a great performance. Just one dancer out of sync or one saxophone player's note slightly off key can throw off the performance. It takes a team approach to choreograph a great ballet. It also takes a great physical therapist to make sure that all of the *team* members are ready to perform. In this issue you will read about the treatment of a saxophone player with a chest deformity, diagnosis using ultrasound to treat a dancer, and much more. Those who perform and create such beautiful art, be it musically or visually, deserve our attention and our caring touch. I hope that after reading this issue of *OP* you will come away with a new appreciation of physical therapy from a slightly different perspective.

The combination of musical instruments in a symphony or the choreography of a troupe of dancers in a ballet company requires harmonious synchronization. Each note played by the individual instruments must be timed just right. Each jump and landing of every dancer requires perfect timing and movement. This is especially important if someone must catch the jumping dancer. I recall watching Saturday Night Live where Gilda Radner was dancing with Steve Martin during a ballet. Now my kids may think that they were wonderful dancers; however, I know enough to know that it was not good ballet. How I knew that this ballet was bad was because of my previous experience and knowing what *normal* ballet should look like. Applying this sort of method of learning to physical therapy reminds me most of what one of my teacher's favorite saying was: "you must know normal kinesiology before you know what abnormal kinesiology is." Just like a well-orchestrated piece of music, normal kinesiology requires the harmony of inter-related joint movements and the synchronous contraction of muscles for purposeful movement.

The inter-relation of muscles and joints working together in creating movement is often taken for granted. For a functional movement of the lower extremity to occur, it requires simultaneous neuronal input and output, carefully controlled muscular contraction, and proper joint motion. As orthopaedic physical therapists I believe our most important attribute is our ability to understand this complexity. By looking not just at a specific body part but at the overall sum of the parts and how these body parts work together, we set ourselves apart from all others in health care. Just as an orchestra has different sections—the horn section, the string, the woodwind, and the tympani sections—all work together in performing a beautiful piece like Beethoven's Fifth Symphony. So too does our body require the inter-relationships between its parts to work harmoniously. Thus, while an orthopaedic surgeon may often focus on a tear of the posterior horn of the medial meniscus, we broadly look at how any possible impairment of the muscles of the knee, the hip joint, the ankle joint, the subtalar joint of the foot, and sometimes even the metatarsophalangeal joint of the hallux may affect the function of the knee. I have always believed that our greatest strength is our ability to look at *the big picture* and understand how all of the parts work together in helping our patients. Tammy Burlis—a teacher at Washington University in St. Louis, MO, a certified specialist in cardiopulmonary physical therapy, and a friend—always tells me, remember Mike orthopaedic physical therapists sometimes forget that your orthopaedic patients also have a heart.

Like an orchestra and the human body, the Orthopaedic Section is made up of many parts, our Standing Committees (Education, Practice, Public Relations, Finance, and Research) our SIGs (the Occupational Health SIG, the Performing Arts SIG, the Foot and Ankle SIG, Pain Management SIG, and Animal Physical Therapist SIG) and our Education Groups (Patellofemoral, PTA, Manual Therapy, and Primary Care). Each are an integral and important part of the Orthopaedic Section and each play an instrumental role (no pun intended). These groups educate our Section members and provide education to non-Section members. They direct, approve, and fund important research questions. They supply much needed pecuniary help to the Section that in turn provides many charitable dollars to important organizations like the Foundation's Clinical Research Network and for scholarships for minority students. I have heard of some who say that the only reason they joined the Orthopaedic Section is because of a SIG. Well, I am glad they are a member but I also am sad that they are missing a big part of what the Orthopaedic Section has to offer. The SIGs are the percussion section of the Orthopaedic Section. The SIG Presidents play an important role in the strategic planning of the goals and objectives (and where money will be spent) of the Section. Just as a musician doesn't join a band so he or she can play solo guitar, the members of our Committees, SIGs, and Education Groups understand their role and share their expertise and hard work to help consummate the Section's goals/objectives and mission/vision. If the goals/objectives and vision/mission of the Section are not consistent with all of our related groups, I am not doing my job as the conductor of this great symphony and I need to know. The SIGs, as well as the Committees and Education Groups, all contribute in achieving our most important goal of all, that is to improve physical therapy (and of course to improve the quality of life of our patients). To do this, the Orthopaedic Section must be well-orchestrated and in harmony with all of our Committees, SIGs, and Education Groups, like the Boston Pops or the St. Louis Symphony Orchestra (whom my great-grandfather came to play with from Bohemia as a bassoonist). We must create beautiful music together. Apart, we are just one single instrument playing to a solo musician, or a lonely dancer lost in the melody of individual chords and tones in time and space.

Orthopaedically yours,
Michael T. Cibulka, PT/MHS, OCS
President

Considerations for Treating the Musician

Nicholas Quarrier, PT, MHS, OCS, Jeffrey T. Stenback, PT, OCS

A survey of 4025 members of the International Conference of Symphony and Opera Musicians (ICSOM) found that of 2122 respondents, 76% reported having had at least one medical problem severe enough to affect performance.[1] A survey of 117 professional music teachers reported that 90% of the respondents had taught students with music-related injuries.[2] The teachers believed the injuries were caused by improper playing technique, poor posture, rapid repetitive movements, poor physical condition, and emotional stress.[2] As minor pain complaints are expected while playing a musical instrument, persistent musculoskeletal problems should not be expected. Persistent pain requires seeking both medical and instructional advice. The music teacher should be made aware of the pain or discomfort, and if changes in technique, practice time, or repertoire do not result in relief, further consultation with someone in the field of arts medicine may be needed.[3]

Most music-related injuries are classified as some variety of overuse injury which often is accompanied by acute tendinitis, myositis, or a nerve impingement.[3-6] The evaluation and examination of these injuries requires knowledge of the instrument played and the physical and emotional demands placed upon the musician.[7] The acute treatment of these injuries is often straightforward and involves reduction of the inflammation and protection of the involved area. The care of the musician becomes more complicated with injuries that are more chronic in nature. In these cases, the examination and intervention can be more involved. It must be stated that if a musician earns his living by making music and is injured, simply instructing the individual to stop playing and to rest the injured body part probably won't work. When offered this suggestion, the musician more than likely will discontinue working with that health care provider and search for another. Just as in a more sports-related patient, it is important that the affected activity is maintained at a high level of function and removing the patient entirely from their craft (unless unavoidable) can be the source of further problems later on. Therefore the psychological implications involved in treating a musician are critical and must be included in treatment considerations.

Efficient care of the injured musician requires a comprehensive understanding of the factors that predispose an individual to an injury. It is conjectured that music-related injuries occur due to a combination of 3 factors: sustained muscle contraction, abnormal joint positioning, and emotional stress leading to abnormal sympathetic nervous system discharge.

SUSTAINED MUSCLE CONTRACTION

Musicians frequently hold much of their tension in the shoulder girdle musculature and may abnormally elevate or depress the shoulders. Myotrac EMG examination of the upper trapezius muscles often confirms the sustained muscle contractions in the proximal muscle groups. This increased muscle tension seems to be pervasive in all instrumentalists, including singers. Persistent elevation/depression may lead to reduced blood circulatory flow into the upper extremities. But, as rapid repetitive movement occurs in the fingers and wrists, the demand for oxygen-rich blood increases. As a result, the sustained muscle contractions in the shoulders may lead to distal ischemic conditions. If ignored and the activity continues, inflammatory agents are produced and tissue irritation may pursue (tendinitis, etc.).

Perhaps contributing to these sustained muscle contractions, many musicians also have proximal muscle weakness throughout the shoulder girdle and upper back which means that stability issues will be prevalent. Aberrant postural changes often include scapular elevation, forward head posturing with suboccipital muscle shortening and rounding of the shoulders with scapular protraction. Accessory muscles that are not meant to substitute for larger postural muscle groups are called into play and frequently are not up to the task. Continued use of these inefficient patterns causes the musician's shoulders to elevate higher and round forward so that the scapulae protract further and the humeral heads are positioned anteriorly. Without a change in this positioning, the pectoral muscles shorten over time, midthoracic muscles become less and less antagonistic, and a more rounded back posture is assumed.

Sustained overactivity in the sternocleidomastoids, rib elevators, and levator scapular muscles lead to an abnormally elevated rib cage and affect inspiratory volume, thus reducing the use of more efficient diaphragmatic breathing. Fatigue is a natural consequence of this aberrant upper quarter postural control. The musician may notice tightness in their jaw muscles, occasional headaches and tension that creeps quickly into their upper back and shoulder—noticing that they "have to play harder," and expend more effort to get the same result musically. As a result, these abnormally tightened muscles rapidly reach an ischemic response—effectively heightening fatigue and further causing a deterioration in playing abilities.

Musicians require good proximal stability to maintain playing postures proximally while their coordination and skill work is done distally. This stability allows for freedom of movement throughout the remainder of the extremity. Obviously regular practice with proper technique is a good foundation for endurance work for a piece like Mahler, for instance. But our patients are better served by incorporating postural awareness exercises (ie, chin retraction with various degrees of cervical rotation or scapular retraction combining different degrees of shoulder abduction/external rotation) that target problem areas and progressive endurance-related activities (eg, UBE at 30° and 60° per second [watch wrist/hand positioning!], repetitive and progressive weighted ball throws [1-5#], and gymnastic ball activities) outside of their musical experience…thus effectively *cross-training* their postural muscles and allowing the muscles they most frequently use to experience different patterns of movement.

ABNORMAL JOINT POSITION

Musculoskeletal units surrounding joints work most efficiently when the joint is held in the neutral position. This is most easily proven by attempting to make a tight fist in both a neutral and flexed wrist position. A much stronger fist is obtained in the neutral position versus the flexed position. When the joints are positioned in any extreme range of motion for an extended period of time and rapid finger activity occurs, muscle and tendons will fatigue sooner than if rapid activity occurs in a more neutral position. Over time, fatigue leads to pain, chemical irritation, and possible

inflammation. The most common abnormal joint positions seen in musicians are wrist ulnar deviation, wrist flexion, finger abduction, and forward head posture. Ulnar deviation has been mostly reported in keyboard players,[8] but is, in our experience, evident with many of the other instruments as well. Musicians must repetitively reposition fingers, wrists, forearms, elbows, and shoulders in rapid succession, occasionally repeating the same patterns over and over and other times changing direction or combinations of joint movements in widely varying amplitudes. The stresses inherent in abnormal positioning that we all associate with poor postural habits are magnified in musicians when requirements of skill and coordination are superimposed. Much of the skill and coordination involved in making music occurs distally, which is probably why these particular abnormal joint positions are so prevalent. Newer movement patterns that are difficult due to repertoire played, lack of familiarity with required fingering patterns or portions of a passage, time spent practicing, current technique or teaching style, and even the size of the performer themselves can result in the assumption of these awkward postures.

Incorporation of a well-designed stretching program, postural awareness program, and ergonomic assessment that targets problem areas can offer the musician a means of self-management and incorporate a level of joint protection to hopefully avoid future reoccurrence (eg, neural stretches for the UE, pectoral, scalene, and levator scapular muscle stretching). Several musicians have even reported onset of symptoms after having changed their bowing style or the bow itself (different bows might be used in some string players that better suit the type of piece being performed, eg, Mozart versus Beethoven). While some changes are most certainly the result of technique itself and are better addressed by the musician's music instructor or someone well-versed in specifics of technique, the effects of these changes posturally are best addressed by the physical therapist.

Acclimation to changes (whether they are postural/positional or technique-related) take time and the musician should allow for a period of transition when making a change or learning a new movement pattern so that they are more acutely aware of the effects of that change. Unfortunately, sheer repetition is often employed by musicians in order to increase proficiency with difficult fingering, for example, but it can push already irritated tissues into an inflamed state (eg, a percussionist practicing a snare drum roll for 15 minute intervals—even though the actual requirement of the piece may be a matter of seconds at a time; a pianist practicing a difficult passage "until she gets it right"). Segmenting their practice time with frequent breaks, breaking up difficult fingering passages or *blocking* the passage into smaller and more easily learned patterns and being aware not to over practice a new movement pattern are important. Obviously, superimposing problems in technique only serves to exacerbate already strained tissues and the forces generated in the involved limb can be quite large when the repetitive nature of the activity is considered.[9]

"The stresses inherent in abnormal positioning that we all associate with poor postural habits are magnified in musicians when requirements of skill and coordination are superimposed."

In addition, other considerations might include, but are not limited to, positioning of the instrumentalist in order to view the conductor or music score, uncomfortable/inappropriate seating, environmental factors (ie, extremes of temperature, smoky or theatrically fogged venues) and cramped rehearsal/performance spaces only complicating the situation. Related activities that are outside of instrumental practice, such as time spent in composition, use of a computer keyboard, writing postures, sleep posturing, and recent weight-training may have contributory influences on the musician's symptoms.

EMOTIONAL STRESS

Proximal muscles become tense with sympathetic nervous system activation (fight or flight response) and become relatively relaxed with parasympathetic nervous system activation. High levels of emotional tension pervade in a music conservatory, school of music, or professional music organization.[10] A simple confirmation of this abnormal sympathetic nervous system activation may be noted using the Heartmath Freezeframer computer analysis system. This system evaluates the individual's heart rate and mathematically converts the signals to demonstrate ANS activation. Many musicians tested show erratic and ineffective breathing patterns, typically seen in upper chest breathers. This response is readily graphically displayed and shows high levels of sympathetic tone. Performance anxiety including fear of failure, stage fright, peer pressure, losing an orchestral seat, jury/recital performance, and poor performance all add to abnormal nervous tension experienced by many musicians.[3,11]

Performance anxiety causes many to complain of chronic cold hands/feet and rapid irregular breathing.[3,12] This increased muscle tension merely adds to the detriment of prolonged sustained muscle contractions.

Many musicians are already aware that they either have a tendency to play with or without tension, as many music teachers are addressing this aspect. The musician will frequently comment on having been told that they play with increased tension and need to relax more. The musician, however, is not always as aware of how to effectively deal with a build up of tension or how to recognize early warning signs that musculoskeletal tightness is imminent. Obviously, active intervention on the part of the musician to effectively avoid an abnormal/excessive stress response is more effective and takes considerably less time than managing a stressful response after it has taken hold. Proper instruction in diaphragmatic breathing techniques or exercises to help improve inspiratory volume as well as relaxation techniques are useful here, in addition to teaching an appropriate home stretching program to target affected areas (eg, lateral rib cage stretching, thoracic *circles* in sitting/standing to improve mobility). Improved diaphragmatic breathing often shows more parasympathetic activation on the Freezeframer. This unit can effectively be used for biofeedback training.

There are a host of various techniques available that can teach relaxation. It is important to pair the correct technique with the learning style of the performer (eg, Jacobsen's contract vs. relax techniques are more concrete and tend to work well with more auditory learners vs. visual imagery techniques that are more effective with visual learners). But there are plenty of other inherent stressors present for the musician, such as an upcoming audition, for example, where a lot is riding on their ability to perform well. The more important the audition is perceived, the more intensely the individual practices—usually to an excess, prior to the event. The accompanying emotional stress appears physiologically as a

cascade of increased sympathetic activity (ie, dryness of the mouth, cold/clammy hands, light headedness, tingling sensations in the extremities, palpitations, tension in the face/jaw and extremities, increase in pulse and respiration) often accompanied by a loss of coordination and an increase in incidence of mistakes.

Psychologically, any negative internal self-talk also is damaging and, if present, the musician may benefit from appropriate intervention by a trained health care professional. Very high expectations of the individual to perform well can aggravate any existing tension. A young double bass player noted that he was experiencing cramping in his fingers and hands that would increase as he pushed through his practice or rehearsal. He had just been told that an important audition was coming up in a city to which he wanted to move back and in which his fiancee was now living. "I really wanted the audition to go well. Everything would be so much easier if I could move back to [that city]...my fiancee wouldn't have to move once we get married." He began excessive practice for several weeks prior to the audition and ultimately had to cancel the audition only a couple of hours prior because his symptoms had worsened enough to cause him to be unable to play. Either way, it is ultimately the individual's performance that is affected if symptoms are ignored.

Peer pressure remains an issue in groups where hierarchy and seniority rule. Upcoming auditions for a first chair position or prime placement in an orchestra are frequent sources of this stress. "I know that even though some of my fellow musicians want the best for me, I also feel that others are secretly happy that I might do poorly at an audition...even though they may wish me well to my face." The competitive nature of hierarchies present in the music world certainly do not appear to be on their way out and musicians will need to be prepared for such stresses as part of their basic training.

CONCLUSION

We have discussed several aspects of injury predisposition in the musician, as well as a few treatment considerations. As physical therapists, recognition of specific movements involved in a dysfunctional state are part of our daily activities. It is not that much different for the population discussed here, with the caveat that it is important to understand the unique factors affecting the instrumentalist. Our abilities as physical therapists in recognizing and treating specific biomechanical dysfunction creates a unique opportunity to influence this patient population. In these authors' experience, the typical injured musician reports more distal extremity pain, abnormal upper back, or shoulder girdle tension, and has been dealing with their symptoms for at least several weeks if not months before seeking treatment. Often, the musician has a very limited idea that what we do can help. There is a definite need for education in this still-emerging area of rehabilitation. We have a chance to share in their pursuit of creating a superior musical experience and hopefully avoiding the pitfalls of a musculoskeletal injury along the way.

REFERENCES

1. Fishbein M, Middlestadt SE, Ottati V, et al. Medical problems among ICSOM musicians: Overview of a national survey. *Med Probl Perform Art.* 1988;4(1):1-8.
2. Quarrier NF. Survey of music teachers: Perceptions about music-related injuries. *Med Probl Perform Art.* 1995;10:106-110.
3. Sataloff RT, Brandfonbrener, Lederman, eds. *Textbook of Performing Arts Medicine.* New York, NY: Raven Press, Ltd.; 1991.
4. Greer JM, Panush RS. Musculoskeletal problems of performing artists. *Bailliere's Clin Rheumatol.* 1994; 8(1):103-133.
5. Lippmann HI. Fresh look at the overuse syndrome in musical performers: Is "overuse" overused? *Med Probl Perform Art.* 1991;6(2):57-60.
6. Lockwood A. Medical problems of musicians. *N Engl J Med.* 1989; 320(4):221-227.
7. Quarrier NF. Biomechanical examination of a musician with a performance-related injury. *Orthop Phys Ther Clinics North Am.* 1997; 6(2):145-157.
8. Wolf GF, Keane MS. An investigation of finger joint and tendon forces in experienced pianists. *Med Probl Perform Art.* 1993;8(3):84-95.
9. Larsson L, Baum J, et al. Nature and impact of musculoskeletal problems in a population of musicians. *Med Probl Perform Art.* 1993;8(3):73-76.
10. Salmon P. A psychological perspective on musical performance anxiety: A review of literature. *Med Probl Perform Art.* 1990;5(1):2-11.
11. Nagel JJ. Performance anxiety and the performing musician: A fear of failure or a fear of success? *Med Probl Perform Art.* 1990;5(1):37-40.
12. Tubiana R, Amadio P, eds. *Medical Problems of the Instrumentalist Musician.* London: Martin Dunitz LTD; 2000.

Nicholas Quarrier, MHS, PT, OCS, c/o Ithaca College, Department of PT, Ithaca, NY. Jeffrey T. Stenback, PT, OCS, Orthopedic Rehabilitation Specialists, Miami, FL.

Editor's Message *(continued from page 5)*

aspect of performing arts. We also have two great articles about treatment of the musician. Additionally, we have two very informative articles about physical therapy intervention for the figure skater.

I would like to take this opportunity to extend my gratitude to the Performing Arts Special Interest Group, and especially Jeff Stenback, PASIG President, for their work on this issue. When I approached Jennifer Gamboa, former PASIG President, and then Jeff, they were very excited about the prospect of doing this issue. The PASIG worked hard to secure authors and Jeff made sure articles were submitted in a timely manner. I would also like to thank the authors for their work as well. Congratulations on a job well done! I can tell you that after reading this issue of *OP*, I have gained new insight into working with performing artists. I have learned much about these clients and their unique needs. I am also reminded of the importance of continued learning for the physical therapist and physical therapist assistant so that we can provide the highest level of care in this specialized and exciting area of practice. I hope you enjoy this issue as much as I.

Susan A. Appling, PT, MS, OCS
Editor, OP

Treatment of Repetitive Stress Injury in a High Altitude Saxophone Player with Pectus Excavatum and Scoliosis

Lynn E. Medoff, MA, MPT
Kim Short, DPT

Repetitive stress injury is a common occurrence in serious musicians, especially those studying at a conservatory or university.[1-5] Faulty posture, breathing, and movement mechanics have been implicated in the development of overuse injury in the musician. Many authors have stressed the importance of addressing a musician's posture and movement mechanics to ensure the successful return to performance.[6-13] We believe that the musculoskeletal complaints that brought this young saxophone player to physical therapy were caused primarily by faulty movement mechanics and poor postural habits. It is also likely that long-term respiratory dysfunction, that this patient did not acknowledge, played a role in the development of poor habits and overuse injuries.

Wind players with faulty breathing mechanics are especially vulnerable to muscle tension and repetitive stress injury.[22,23] Many factors affect breathing efficiency in the wind player: embouchure and orofacial structures, skeletal structure, muscular strength and endurance, cardiovascular and pulmonary health, activity level, environment and emotional stress.[3,4,14-21,23,24] Medical problems of saxophone players are rarely discussed in the literature. This may be due to the fact that the saxophonist is not an orchestral player and thus not readily available for study. In addition the environmental influences of the club setting in which sax players often perform are difficult to control for.[25]

Structural, functional, and environmental factors play a significant role in the development of breathing problems and musculoskeletal pain in the saxophone player described in this case study. He presented with a chest deformity and scoliosis, played at high altitude, and has asthma. Pectus excavatum (PE) is a congenital depression of the sternum, which leads to a restrictive lung disorder. The heart is pushed into the lateral and posterior aspect of the left thorax.[26] Pectus excavatum alters the dynamics and mechanics of breathing and heart function.[26-30] Common symptoms include dyspnea on exertion, chest pain, wheezing, inability to take deep breaths, and decreased exercise tolerance. Significant pulmonary function changes have been reported.[31,33,34] The patient also was diagnosed with asthma, a reversible obstructive lung disorder, which is characterized by wheezing, dyspnea, chest tightness, and cough. It is often induced by exercise.[22] The patient first noticed shortness of breath and wheezing when he moved from sea level to 7,000 ft. Playing a wind instrument at altitude is not addressed in the literature. We therefore looked to research that addresses exercise at altitude. It is well documented that performing exercise at high altitude stresses the cardiovascular system.[32] This is true of trained athletes as well as of asthmatic children. A study by Cibella et al found a decrease in VO_{2max} and an increase in breathing workload in athletes training for 1 month at 15,150 ft.[35] A study of asthmatic children exercising in an atmosphere-changing chamber from sea level to 4,500 ft. found that respiratory rate and ventilatory anaerobic threshold were higher with exercise at altitude.[36] Thus aerobic power and oxygen diffusion were reduced when exercising at altitude.

The purpose of this case study is to identify the factors contributing to the development of repetitive stress injury in a young saxophone player. We present the unique combination of factors that adversely affected breathing mechanics and posture and describe the neuromuscular re-education process that allowed the musician to return to his desired level of practice and performance.

CASE DESCRIPTION

The patient was a 20-year-old male saxophone player, who was a music performance major at a high altitude university (7,000 ft.). He practiced the saxophone 2 hours daily, played the piano 1 hour daily (mainly for composing), and performed in 3 musical groups. In addition, he taught 2 saxophone students, was enrolled in 18 hours of classes, and worked 22 hours a week as a waiter. The patient presented with a chief complaint of pain in the dorsum of his right hand, wrist, and forearm that began 1 1/2 weeks ago. Symptoms coincided with increased practice on the saxophone and piano to prepare for upcoming concerts. Aggravating activities (from worst to least) included: (1) using the computer mouse, (2) writing, (3) playing the saxophone or piano for extended periods of time, and (4) waiting tables. Symptoms decreased with rest from aggravating activities. Patient also reported chronic mild low back pain. Patient did not exercise regularly.

Evaluation revealed the following structural abnormalities in standing: right thoracic scoliosis, right scapular winging and protraction, and significant pectus excavatum chest deformity. The patient was identified to have a sway-back posture as described by Kendall and McCreary.[22] When playing the saxophone this posture was exaggerated, the trunk was rotated to the right, and the right wrist was fixed in an extended position close to the right hip. His playing style was tense. Postural faults while seated at the keyboard were identified as rounded shoulders, sunken chest, rounded thoracic and lumbar spine, and extended cervical spine and head. Lumbar and thoracic spinal mobility were reduced so that it was difficult for the patient to maintain an upright posture in sitting. Manual muscle testing of the scapula and shoulder as described by Kendall[37] revealed weaknesses, R>L of the rhomboids, lower trapezius, middle trapezius, latissimus dorsi, and teres major. Strength testing of the wrist, hand, and fingers revealed weaknesses, R>L of the EPL, EPB, ODM, and ADM (see Table 1). Upper extremity sensation was WNL. Nerve tension tests as described by Butler[38] revealed slight irritability of the right median nerve at end range stretch when compared to the left. Tingling in the fingertips occurred with scapular depression and end range shoulder elevation. Bilateral pectoralis minor, scalene, and upper trapezius tightness was noted. Throughout the interview and when playing his saxophone the patient was short of breath and a slight wheeze could be heard. It was noted that he was a chest breather. When questioned about breathing problems, the patient noted some shortness of breath since beginning study at the university. He denied previous breathing problems and was unaware that he had a chest deformity.

Table 1.

	Initial		Re-evaluation (3 month)	
	Kendall Muscle Grades (normal=5)			
	R	L	R	L
Rhomboids	4	4	5	5
Lower Traps	3	3+	4	5
Mid Traps	3+	4	4+	5
Lat Dorsi	3	3+	4	4
Teres Major	3	3+	4	4+
EPB	3	3+	4+	4+
EPL	3	3+	4	4
ODM	3+	5	4	5
ADM	3	3	4+	4

We hypothesized that UE symptoms were due to muscle/tendon strain caused by repetitive use of the computer mouse, writing, and playing the saxophone and piano. Predisposing factors were determined to be structural abnormalities and faulty posture that led to poor trunk stabilization, muscular weakness, inefficient breathing mechanics, and muscle tension. We further hypothesized that scapular and shoulder strength would improve and hand pain would decrease with improved posture, trunk stabilization, and movement mechanics.

TREATMENT

A treatment plan was designed to address the following impairments: wrist, hand, and finger weakness and pain; shoulder and scapular weakness; structural abnormalities; faulty posture; inefficient breathing mechanics; and decreased spinal mobility. It was important to consider the environmental and situational factors of living at a high altitude; an intense school, performance, and work schedule; and lack of physical exercise. During initial intervention (the first 5 sessions over a 6-week period), the patient was instructed in relaxation training and diaphragmatic breathing exercises and neuromuscular re-education exercises to improve posture and movement mechanics. Training was based on the teachings of kinesiologist, Mabel Elsworth Todd and her student, Lulu Sweigard who developed ideokinesis, imagined movement exercises to change postural and movement habits.[39] Abdominal hollowing exercises as described by Richardson and Jull were used to train the transversus abdominis muscle to stabilize the pelvis and low back.[40] Posture and movement mechanics when sitting at the keyboard and when playing the saxophone were addressed at each session. When sitting at the keyboard, he was taught to re-establish the normal curvature of the spine and align his trunk without tension. When playing the saxophone in standing he was taught to prevent the hips from swaying forward and to avoid rotation of the trunk. This allowed him to hold the saxophone more in front and to relax the rigidly held extended right wrist. Back mobility and pelvic stabilization exercises enabled the patient to more easily maintain corrected alignment. The patient was instructed to chunk his practice time into 15- to 30-minute segments and to practice relaxation and breathing exercises during breaks. He also was encouraged to decrease writing and computer use. Finally, the patient was encouraged to consult with a respiratory specialist. During the third treatment session, patient reported decreased hand and wrist pain. He noted that paying attention to his posture while playing the saxophone was helpful. He was performing the exercises every other day but was having difficulties finding a quiet, comfortable place to do the breathing exercises. There was an 8-week break in therapy due to winter break and a busy schedule when the patient returned to school.

Sessions 6 through 10 took place over a 6-week period. During session 6 (3 months following the start of treatment), the patient reported that his symptoms had deceased significantly. His wrist and hand were rarely painful, and his low back no longer ached. He noted that his saxophone playing was much more relaxed. Symptoms no longer limited the amount of time the patient wished to devote to playing the saxophone or piano. When symptoms did present, they were minor and easily reversed. The patient reported continued wheezing and shortness of breath but had not yet seen a physician. Treatment during sessions 6 through 10 consisted primarily of fine-tuning posture and movement mechanics, and reviewing breathing and conditioning exercises. During this period, the patient demonstrated improved posture in sitting and standing and playing his instruments. His pelvis was no longer posteriorly tilted and his torso was lengthened, balanced, and supported. Manual muscle testing revealed increased strength in all muscles that had previously tested weak (Table 1). Nerve tension tests were negative. The patient consulted a respiratory specialist before visit 8. Pulmonary function studies revealed obstructive disease (decreased FEV 25-75, suggestive of asthma) and restrictive disease from marked pectus excavatum. Asthma reversed significantly with a bronchodilator. Patient was placed on Azmacort and Albuterol. During session 9, the patient was placed on an exercise program at the student recreation center. The program consisted of 30 minutes of cycling, pelvic stabilization, stretching, back conditioning exercises, and upper body weight training. The amount of weight lifted was determined by how much the patient could lift 20 times with relaxed, balanced alignment and efficient trunk stabilization. Performance of patient's exercise program was assessed 3 weeks later. Patient reported that he was exercising 2 times per week and that the aerobic and weight training and asthma medicine were helpful in improving breath control and endurance and decreasing stress. He was not consistent in performing the relaxation and breathing exercises because he still had not found a comfortable place to do so. He had no complaints of hand, arm, or low back pain. Patient demonstrated excellent posture and movement mechanics and was discharged from physical therapy. The following day he was re-evaluated by the respiratory specialist and repeat spirometry was performed. FEV 25-75 still showed a moderate decrease and significant improvement with the bronchodilator.

FOLLOW UP

The patient was interviewed 6 months later. Upper extremity symptoms were infrequent and when they did occur, they resolved quickly. The patient noted that continued attention to good alignment when playing the saxophone allowed him to play pain free. Hand and arm symptoms most commonly presented with composing on the piano due to tendencies to slouch when absorbed in his work. He was still exercising at the recreation center; however, this was becoming increasingly difficult due to increased school demands. Practicing balanced relaxed posture was a priority; however, he rarely performed the relaxation and breathing exercises. The patient noted increased jaw and embouchure tension when playing his saxophone. He did not follow up with care by the respiratory specialist because of money worries despite his concern that he was becoming increasingly dependent on the Albuterol inhaler. The patient was encouraged to work out a payment plan with the physician and to follow through with treatment. He was also encouraged to be consistent with his exercise training. Two weeks later he still had not followed through with these suggestions.

DISCUSSION

Serious musicians are similar to highly competitive athletes and dancers in that they push themselves to perform through pain. Only when the pain interferes with their ability to compete or perform do they seek professional help. The young saxophonist presented in this case study sought help only after his hands became part of the problem. He was oblivious to the structural faults, environmental factors and underlying postural faults, breathing problems, and muscular tension that preceded and were instrumental in producing his hand pain. Health professionals must be sensitive to the fact that he, like other serious student musicians, is an intense individual, who deals daily with a lot of stress. He is overworked and consumed with bettering his skills in preparation to exist in a highly competitive field. It is important to effect positive changes in as little time as possible and to get the musician involved in his treatment. Our patient experienced an immediate decrease in symptoms following changes in posture and was therefore more willing to follow through with treatment. Treatment must not impose upon the musician's already busy schedule. Thus, posture and movement retraining was integrated into daily functional activities. In addition, we attempted to insert his home program into time already set aside for practice. This was unsuccessful because he was not comfortable exercising in his practice space. The assumption that neuromuscular re-education of posture and movement habits would result in improved strength of upper quadrant musculature proved to be correct. Several researchers including Janda, Kendall and McCreary, Sherrington, and Sahrmann profess that poor bony alignment creates muscular imbalances that adversely affect muscle strength.[24] Involvement in a conditioning program that included aerobic exercise appeared to be most helpful in decreasing the patient's muscular tension and breathing problems. During his 6-month follow up, the patient admitted that he was not as consistent with his exercise program. He reported increased muscle tension and increased dependency on his Albuterol inhaler. Treatment was effective in that the musician was able to return to his desired level of practice and performance on the saxophone and the piano. In addition he now has the knowledge and skills to control his symptoms and improve his physical well-being. Long-term follow though is in his hands.

REFERENCES

1. Fishbein M, Middlestady SE, Ottati V, Strauss S, Ellis A. Medical problems among ICSOM musicians: Overview of a national survey. *Med Probl Perform Art.* 1988;3:1-8.
2. Fry HJH. Incidence of overuse syndrome in the symphony orchestra. *Med Probl Perf Art.* 1986;1:51-55.
3. Larsson LG, Baum J, Mudholkar GS, Kollia GD. Nature and impact of musculoskeletal problems in a population of musicians. *Med Probl Perform Art.* 1993;8:73-76.
4. Lockwood AH. Medical problems of musicians. *N Engl J Med.* 1989; 320:221-227.
5. Roach KE, Martinez MA, Anderson N. Musculoskeletal pain in student instrumentalists: A comparison with the general student population. *Med Probl Perf Art.* 1994;9:125-130.
6. Zaza C, Farewell VT. Musicians' playing-related musculoskeletal disorders: An examination of risk factors. *Am J Ind Med.* 1997;32:292-300.
7. Byl NN, Arriaga R. Treating the injured musician. *Phys Ther.* 1993:162-168.
8. Cailliet R. Abnormalities of the sitting postures of musicians. *Eighth Ann Symp Med Probl Mus Dan.* 1990.
9. Milan KR. Literature review of common injuries in the performing artist. *Orthop Clin North Am.* 1996;5:421-452.
10. Amadio PC, Russotti GM. Evaluation and treatment of hand and wrist disorders in musicians. *Hand Clinics.* 1990;6:405-416.
11. Zaza C. Research-based prevention for musicians. *Med Probl Perf Art.* 1994;3:3-6.
12. Lowe C. Treatment of tendonitis, tenosynovitis, and other cumulative trauma disorders of musicians' forearms, wrists, and hands ... restoring function with hand therapy. *J Hand Ther.* 1992;Apr-Jun:84-90.
13. Markison RE, Johnson AL, Kasdan, ML. Comprehensive care of musical hands. *Occup Med.* 1998;13:505-511.
14. Zaza C. Musicians' playing-related musculoskeletal disorders: an examination of risk factors. *Am J Ind Med.* 1997;32:292-300.
15. Quarrier NF. Survey of music teachers. *Med Probl Perf Art.* 1995; Sept:106-110.
16. Hartsell HD, Tata GE. A retrospective survey of music-related musculoskeletal problems occurring in undergraduate music students. *Physiother Canada.* 1990;44:13-18.
17. Fry HJH. Patterns of over-use seen in 658 affected instrumental musicians. *Int J Music Educ.* 1988;11:3-16.
18. Smith WE. Medical problems of orchestral musicians according to age and stage of career. *Med Probl Perf Art.* 1992;Dec:132-134.
19. Elbaum L. Musculoskeletal problems of instrumental musicians. *J Orthop Sports Phys Ther.* 1986;8:285-287.
20. Farkas P. Medical problems of wind players: A musician's perspective. *Cleveland Clin Found.* 1986;53:33-37.
21. Howard JA, Lovrovich AT. Wind instruments: The interplay with orofacial structures. *Med Probl Perf Art.* 1989;Jun:59-72.
22. Sataloff RT, Spiegel JR, Hawkshaw M. The effects of respiratory dysfunction on instrumentalists. *Med Probl Perf Art.* 1990:94-97.
23. Bouhouys A. Pressure-flow events during wind instrument playing. *Ann NY Acad Sci.* 1968:266-268.
24. Gilbert TB. Breathing difficulties in wind instrument players. *Maryland Med J.* 1998;47:23-27.
25. Thrasher M, Chesky KS. Medical problems of saxophonists: a comparison of physical and psychosocial dysfunction among classical and not-classical performers. *The Sax Symp.* 1999:77-84.
26. Haller JA, Loughlin GM. Cardio-respiratory function is significantly improved following corrective surgery for severe pectus excavatum. *J Cardiovasc Surg.* 2000;41:125-30.
27. Wynn SR, Driscoll DJ, Ostrom NK, et al. Exercise cardiorespiratory function in adolescents with pectus excavatum. *J Thorac Cardiovasc Surg.* 1990;99:41-47.
28. Haller JA, Schere LR, Turner CC. Evolving management of pectus excavatum based on a single institutional experience of 664 patients. *Ann Surg.* 1989;209:578-583.
29. Majid PA, Zienkowicz BS, Roos JP. Pectus excavatum and cardiac dysfunction: A case report with pre- and post-operative hemodynamic studies. *Thorax.* 1979;34:74-78.
30. Blickman JG, Rosen PR, Welch KJ, et al. Pectus excavatum in children: Pulmonary scintigraphy before and after corrective surgery. *Radiology.* 1985;156:781-782.
31. Xiao-ping J, Ting-ze H, Wen-ying L, et al. Pulmonary functional for pectus excavatum at long-term follow-up. *J Pediac Surg.* 1999;34:1787-1790.
32. Schoene B. Lung disease at high altitude. *Adv Exp Med Biol.* 1999; 474:47-56.

(continued on page 18)

Boston Ballet Student Screening Clinic: An Aid to Injury Prevention

Heather Southwick, PT, Michelina Cassella, PT

INTRODUCTION

Physical screening assessments have proved to be effective in not only reducing injury, but also have provided a means for early problem identification which can positively alter the course of treatment. It has been well established in the literature that screening assessments for dancers are effective in reducing injury.[1-3] Health care professionals involved in the treatment of dancers recognize that dancers are a unique group of athletes. The field of sports medicine has often used different screening programs to identify potential problems and initiate appropriate intervention in an effort to prevent injuries.[4-7] Garrick has recommended an orthopaedic screening examination for all children who are planning to participate in sports.[8] The examination is designed to identify congenital and acquired musculoskeletal problems that may either place the athlete at risk for injury or compromise attempts at athletic endeavors.

Similar screening programs for dancers can help to identify and establish norms for this specialized population for body alignment, flexibility, and strength. Several articles have been published citing the benefits of screening programs for dancers.[9,10] Consistently throughout the literature, there appears to be no attempt to use the results of screening programs to determine who should or should not continue to dance. Most programs are used to educate the dancers and make recommendations for developing improved strength, endurance, and mobility. Performing dance screenings and analyzing the results allows for the dance medicine practitioner to work toward the goal of establishing a standardized screening tool that is both objective and reliable. As the knowledge of dance medicine increases, this need seems to become more important as there are no regulatory agencies in existence to standardize teaching practices or to ensure minimal safety and educational criteria for dance teachers or schools. As a result, most dance training curricula continue to be dictated by artistic habits passed down through the years and do not incorporate modern conditioning or biomechanical principles, which would assist in the preparation of young dancers and help prevent injuries.

With these goals in mind, a clinic has been established at the Boston Ballet Center for Dancer Education to provide students with an opportunity for screening assessment and consultation with a physical therapist. The program for students was originally introduced as a 1-year pilot program for the 1996-1997 school year. Due to the success of the pilot program, a monthly clinic was established and is currently in its fifth year.

There are 5 major objectives of the program. The first is to provide affordable access to physical therapy services for screening, consultation, and treatment. Since most medical insurance companies will not reimburse for preventative services such as screenings, a flat reduced rate on a fee-for-service basis is charged. Medical insurance is billed only if the dancer has a medical diagnosis that requires treatment. The second objective is to identify potential risk factors in an effort to minimize and/or prevent serious injuries. The third objective is to educate and communicate with students, parents, dance instructors, and other professionals, as necessary, regarding the student's risk areas. The fourth objective is to offer the program at a convenient time and location. The last objective is to assist students in improving physical criteria necessary for a given level of performance.

METHOD AND MATERIALS

The clinic is held on the first Saturday of every month during the ballet school season. Appointments are scheduled at half hour increments through the physical therapy department at Children's Hospital. Parents must sign a consent form for physical therapy evaluation and treatment. Parents are also encouraged to be present at the assessment. This enables the therapist to have an ongoing dialogue with parent and student thus answering questions as they arise. Over the past 4 seasons, all screenings have been conducted by the same physical therapist who also has a background in dance. This continuity has allowed for consistent follow-up care as necessary.

The screening tool is a 4-page form on which only positive findings are recorded. The screening tool is based on the tool that has been used to screen the Boston Ballet Company dancers but is more specific for the pediatric and adolescent population (Figure 1). A brief but

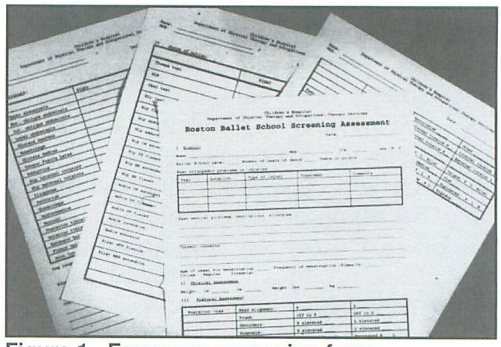


Figure 1. Four page screening form.

detailed history is taken for each subject with parents assisting to provide information as necessary. Items include name, date of birth, ballet school level, number of years dancing, and number of years en pointe. Past and current orthopaedic problems and/or injuries are included as well as a history of medical problems, medications, and allergies. When applicable, menstrual history is also recorded detailing age of onset, frequency and number of cycles per year, and if cycles are regular or irregular. The student's current concern or main reason for seeking physical therapy services is recorded and discussed prior to the screening.

The physical assessment consists of posture, range of motion, strength, manual muscle testing, and comments/observations of dance technique as it pertains to alignment. Height and weight are recorded, and all subjects are asked about recent growth spurts. Posture is evaluated from anterior, posterior, and lateral views with close attention to spinal asymmetries and lumbar/pelvic alignment. Joint alignment is assessed with special emphasis on knee alignment, position of the tibia, and foot alignment. Range of motion is evaluated with special attention to ranges needed for dance activities. Passive ranges that appear limited or excessive are measured with a goniometer and recorded. Range of motion at the hip, knee, ankle, and first metatarsal-phalangeal joint is examined, as well as the Thomas test, straight leg raise, Ober test, and Ely test.[11-13] Strength is evaluated using the manual muscle testing methods described by Kendall, McCreary, and Provance.[14] Muscles imperative for proper dance technique are examined closely and include major muscle groups in the lower extremity, as well as detailed testing of the upper, lower, and oblique abdominal muscles. As many young dancers have complaints of knee pain,

special attention is given to patella position and tracking. Ballet technique is briefly evaluated for alignment issues, with the dancer demonstrating first and fifth positions, tendue to seconde, and occasionally develope to seconde (Figure 2).

Positive results from the screening are then reviewed with the dancer and consist of one or more recommendations for follow-up care. These recommendations can include one or more of the following: referral to physician—either pediatrician or sports medicine physician—specializing in dance-related injuries, pursue further physical therapy treatment, consult with dance instructor, and initiate a home exercise program. A home exercise program is taught and written instructions are given to each student. In order to promote compliance the exercises are kept to a maximum of 3 to 5 and the students are encouraged to do them daily (Figure 3).

RESULTS

In the authors' opinion, the following positive findings appear to have the greatest impact on ballet training. Eighty-two students have been screened over the first 4 years of the screening program. Seventy-nine of those students were female and 3 students were male with ages ranging from 7 to 16 years with a mean age of 11. Twenty-two students were seen for follow-up. A majority of the students seen in the clinic are in the intensive level, which is a preprofessional track. Students in the intensive level take ballet class 5 to 6 times a week and occasionally have the opportunity to perform with the Boston Ballet Company on stage.

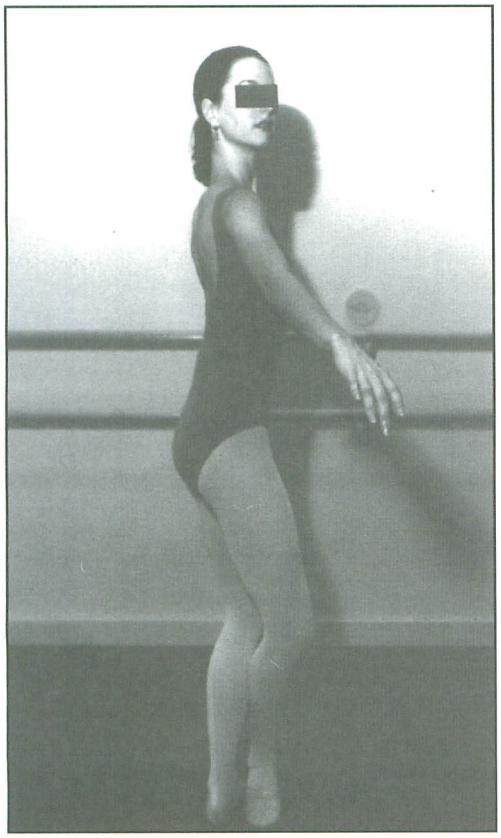


Figure 2. Demonstration of trunk, hip, and lower extremity alignment fifth position.

The most common posture deviation was an increased lumbar lordosis with an anterior pelvic tilt with 96% recorded as positive. When ballet technique was evaluated, 66% were noted to force turn-out with 60% of the students achieving forced turn-out with an increased lumbar lordosis. This positioning promotes tightness of the hip flexors and weakness of the lower abdominals. Range of motion assessment revealed that 96% had a positive Thomas test for iliopsoas tightness measuring at 20° or greater. Upon follow-up, 64% improved with an increase in flexibility. Eighty-seven percent had a positive straight leg raise for hamstring tightness measuring at 90° or less with a range of 40° to 85°. Although the standard range for a positive straight leg raise is 70°, the authors' feel that dancers need to have at least a 90° straight leg raise for proper ballet technique. When re-evaluated for follow-up, 61% showed an increase in hamstring flexibility ranging from 5° to 25°.

Internal and external rotation at the hip are carefully measured with the hip in flexion and extension. Fifty-six percent of the dancers had a lack of passive external rotation with the hip extended. Normal range of motion for hip external rotation is 45°; students with less were recorded as positive. With follow-up, 100% were noted to have increased external rotation after stretching. Sixty-five percent were noted to have decreased dorsiflexion at the ankle. Dancers spend so much time with their ankle joint in plantarflexion that they tend to lose ankle dorsiflexion and this often leads to Achilles tendonitis, as well as other injuries.

Positive findings for strength deficits also were noted. Abdominal muscles were weak in many of the dancers with 36% having upper abdominal weakness with a grade of 4 out of 5 or lower. One-hundred percent of the students who returned for follow-up improved by at least one muscle grade with a home exercise program addressing upper abdominal strength. One-hundred percent of the dancers screened had weakness of lower abdominals with a grade of 3 out of 5 or lower. Seventy-eight percent improved by at least one muscle grade after given exercises to address the lower abdominal muscle weakness. Ninety-five percent of those screened had weakness in the hip adductors with a grade of 3 out of 5 or lower. The adductors are one of the major muscle groups that assist in maintaining turn-out when the leg is in the air. Upon follow-up, 69% showed improvement by at least one muscle grade with a home exercise program addressing adductor strength.

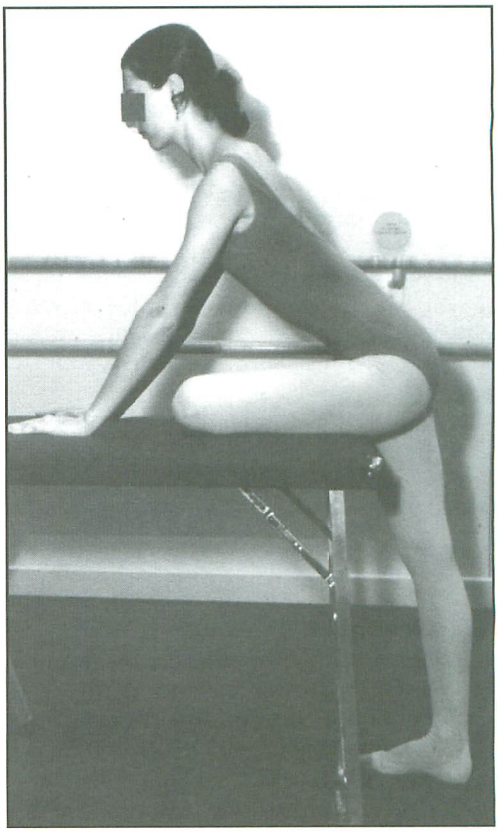


Figure 3. Student performing an exercise to stretch the gluteus maximus muscle.

Recommendations were made following the screening with 91% given a written home exercise program addressing areas of tightness or weakness. Nine percent were not given a home exercise program initially because it was necessary to refer these patients to a physician for further evaluation. A total of 30% were asked to follow-up with a physician for further evaluation; 20% were recommended for consistent physical therapy treatment; 25% were asked to follow-up at the clinic in one month; 57% were told to follow-up with physical therapy as needed; and 30% were asked to follow-up with his or her dance teacher.

DISCUSSION AND SUMMARY

The results presented here support the value of screening ballet students at various stages of their training. As further advances in dance medicine are made, it becomes more apparent that we cannot rely on the notion that training alone will

prepare students for the demands of ballet. Physical therapists can assist teachers and students in identifying areas of weakness or tightness that make it difficult for a student to improve his or her technique. While the results presented here demonstrate that a home exercise program can improve areas of weakness and/or tightness, the next step will be to apply these improvements to technique in an effort to prevent injury and enhance overall dance performance.

REFERENCES

1. Plastino JG. The university dancer: Physical screening. *J Phys Educ, Recreation Dance.* 1987;58(5):30.
2. Molnar M, Esterson J. Screening students in a pre-professional ballet school. *J Dance Med Sci.* 1997; 1(3):118-121.
3. Liederbach M, Spivak J, Rose D. Screening for functional capacity in dancers: Designing standardized, dance specific injury prevention screening tools. *J Dance Med Sci.* 1997;1(3):107-112.
4. Rooks DS, Micheli LJ. Musculoskeletal assessment and training : The young athlete. *Clin Sports Med.* 1988; 7(3):641-677.
5. Mueller FO, Ryan AJ, eds. *Prevention of Athletic Injuries: The Role of the Sports Medicine Team.* Philadelphia, Pa: F.A. Davis Co; 1991.
6. Van De Loo DA, Johnson M. The young female athlete. *Clin Sports Med.* 1995;14(3):687-707.
7. Overbaugh KA, Allen JG. The adolescent athlete. Part II: Injury patterns and prevention. *J Pediatr Health Care.* 1994;8(5):203-211.
8. Garrick JG. Orthopedic participation screening examination of the young athlete. *Pediatr Clinics North Am.* 1990;37(5):1047-1056.
9. Siev-Ner I, Barak A, Heim M, Warhavsky M, Azaria M. The value of screening. *J Dance Med Sci.* 1997;(3):87-92.
10. Schon LC, Biddinger KR, Greenwood P. Dance screen programs and development of dance clinics. *Clin Sports Med.* 1994;13(4):865-882.
11. Thomas HO. *Diseases of the Hip, Knee, and Ankle Joints with their Deformities, Treated by a New and Efficient Method.* Liverpool, England: T. Dorr & Co.; 1876.
12. Magee DJ. *Orthopedic Physical Assessment.* 2nd ed. Philadelphia, Pa: W.B. Saunders Co.; 1992:267.
13. Ober FR. Backache: A monograph. Springfield, Ill: Charles C. Thomas; 1955.
14. Kendall F, McCreary E, Provance P. *Muscles Testing and Function.* 4th ed. Baltimore, Md: Williams and Wilkins; 1993.

Heather Southwick, PT, Department of Physical Therapy and Occupational Therapy Services, Children's Hospital and Boston Ballet Company, Boston, MA. Michelina Cassella, PT, Acting Director, Department of Physical Therapy and Occupational Therapy Services, Children's Hospital and Boston Ballet Company, Boston, MA.

Advocating for Dance Science Education

Gayanne Grossman, PT, MEd

INTRODUCTION

During the 22nd Winter Olympic Games, a story aired that described the technological and scientific advances that make athletes go faster and farther. Athletes yearn for scientific advances while the benefits of dance medicine and science have not permeated throughout the dance community and continue to remain a hard sell in many dance venues. Most dancers have little scientific knowledge that will promote improved performance.

For athletes, scientific knowledge may be the means to a better anatomic and physiologic understanding aimed at improving athletic prowess. Further, those willing to provide medical care and education for athletes are abundant. The situation is different for dancers. Some dancers may perceive science to be a threat to artistry; educators can alleviate this concern by distinguishing dance science from dancing.[1] Further, dancers may see the dance scientist as an angry parent waiting to scold them for bad behavior such as forcing turnout, lack of strength, over working, or under working. This perception is, in part, based in truth. The problem is complicated by the dancer's fear of injury,[2] possible vulnerability to low self-esteem,[3] and heightened *concern for mistakes* found as one subscale of perfectionism.[4] When scientific education is sought, the information gleaned may be used for self-flagellation, eg, "I am never going to be perfect or I am going to hurt myself with this, that, or the other activity."

There are relatively few practitioners specializing in the care and scientific education of dancers. Therefore, the dancer's exposure to science may be limited. Without high quality dance science educators, dancers may search for but can not find useful information to correct problems or improve technique.

DANCE SCIENCE EDUCATION

For dancers, user-friendly scientific education is the answer. How can we best educate dancers to ensure learning, integration, and subsequent abstraction of scientific concepts? A supportive approach to dance science education may engage the dancer more fully than would a negative approach. One should carefully consider the verbiage used when educating any athlete, including dancers. Sports physical therapists provide an excellent example. Wishing to demonstrate proper pitching techniques to a high school baseball team, the physical therapist may include mention of the dangers of incorrect technique as a learning tool. The PT rarely if ever gives examples of degenerated shoulders and graphic slides of the progression through rotator cuff surgery and rehabilitation; instead, methods to improve pitching technique are offered. Likewise, it may not be prudent to educate the lay dance community by providing lectures that thoroughly describe the injuries and degenerative changes suffered by dancers. When these injuries are discussed with exhausting attention to detail including films of cartilage degeneration, small bony fragments, and testimonials of careers ended in their prime, it may affect the dancer's psychological well being and distance the dancer from science. Though negative reinforcement may dissuade dancers from postural malalignments such as forced turnout, a positive approach may achieve the same end and encourage the dancer's sense of empowerment.

"Without high quality dance science educators, dancers may search for but can not find useful information to correct problems or improve technique."

With accurate and comprehensible scientific material, dancers can improve their technical prowess and become liberated from the physical constraints of conscious motor organization. This will allow them to dance freely from the heart and soul. Therefore, our role as educator/physical therapist becomes, similar to sports physical therapists, that of performance enhancer.

EDUCATIONAL VENUES

The scientific education of dancers occurs in many settings including institutions of higher learning, private schools, community seminars, national and international conferences, and journals. Successful teaching methods vary with each arena.

University or college kinesiology courses are ideal settings for a grassroots effort to create a new and larger generation of dance scientists. Many student dance kinesiologists will be future educators and researchers. It is important not to lose these fledgling dance scientists in the abyss of scientific language or the complications of scientific theory. Introduction to kinesiological analysis is less difficult when dancers have had time to integrate some basic anatomical concepts. If possible, human anatomy should be a prerequisite for dance kinesiology. Educators should consider that many dancers are kinesthetic learners and couple lecture with active studio work. Laudable goals for this type of class are to teach the students to develop an eye for movement analysis and alignment assessment of self and others and to apply kinesiological principles to improve dancer performance.

It is widely accepted within the medical community that it may be unsafe practice to teach lay people self-diagnosis and treatment. Therefore, if the dance program wishes to include advanced study of first aide or dance injuries, an additional course is an appropriate choice.

Private dance schools and community seminars can be excellent settings for the introduction of dance science to dancers and their parents. Lectures or workshops on performance enhancement techniques are appreciated. To assure the audience is engaged, choose language that everyone can understand and incorporate only concepts that can be grasped in your allotted time frame (usually about an hour). Clear communication of one concept is considered a success in this type of setting. For instance, classes can be given on either finding a neutral pelvis, how to plié without rolling in, techniques to get the arabesque higher, etc. Challenges can be discussed and a few exercises (approximately 3 to 5) can be offered. The goals are that dancers thoroughly understand the material and comply with the exercise program.

TRAINING THE EDUCATOR

Workshops and conferences by a variety of medical personnel to train physical therapists about the needs of the dancers exist and are valuable tools for anyone

wishing to care for this population. Training a dance science educator is a different matter. According to The National Association of Schools of Dance (NASD) standards, which is the accrediting body for dance programs in higher education in the United States of America, institutions of higher learning are not required but should consider anatomy and kinesiology course work important for undergraduate dance majors. The NASD does not mention it for graduate-level dance students in practice or research-oriented degree programs.[5] Individual graduate programs may choose to require course work in dance science or not. These graduate degree programs include: Masters of Fine Arts, Masters of Arts, Masters of Arts or Masters of Science in dance education or dance therapy, Specialist in Education, Masters of Arts in Dance History, Philosophy, Criticism, or Doctor of Philosophy in the Field of Dance Scholarship or Education.[5] In addition, only 3 universities offer graduate degrees in dance science or kinesiology. Although, a large percentage of masters and doctoral students in dance will seek and subsequently achieve full-time faculty appointments that require instructional skills in multiple areas of dance academics including dance science.

Cardinal and Hilsendager suggested each college or university dance program hire a full-time dance scientist.[6] Unfortunately, dance programs in higher education simply may not be able to train an adequate number of dance students qualified to teach performance enhancement through an understanding of anatomy and kinesiology. Compounding this picture, dance programs often cannot justify a salary line for a full-time dedicated dance scientist. Lack of educator training and resources for dance scientists obstructs the integration of dance science and dance training. Physical therapists can provide a useful public service by offering to teach dance kinesiology in institutions of higher learning as an adjunct faculty member.

RESEARCH

Research publications in dance medicine are directed at the scientific audience. While it is important that physicians, physical therapists, and other scientists can share scientific advances, often the dancer is able to gain new information only through happenstance. For example, if the dancer happens to have contact with a physical therapist they may gain information that leads to new insights. These will most likely be injury or issue specific rather than a broad understanding.

Articles generated on methods to improve dancer skill and the long-term benefits of dancing are of use to the dancing public at large. These articles are uncommon and often published in scientific journals that dancers may never see. One suggestion might be simultaneous publication of an article summary, comprehensible to the lay public, in popular magazines that dancers read.

SUMMARY

Physical therapists that educate dancers need to market the benefits of dance science in their geographical area and nationwide. The tone and language used with dancers should be positive. The psychological well-being of the dancer/athlete being should be considered. To introduce dancers to a variety of injuries is not fruitful and may not lead to long-term interest. Positive reinforcement and the promise of improved performance may yield greater results.

These approaches would sell the benefits of dance medicine and generate the dancer's own quest to learn and incorporate scientific advances. More dancers would be reached and information shared would serve to elevate dance science appreciation within the dance community.

REFERENCES

1. Grossman G. The biomechanics of poorly controlled turnout. In: *Dancing in the Millennium Conference Proceedings.* 2000:222-225.
2. Mainwaring LM, Krasnow D, Kerr G. And the dance goes on. Psychological impact of injury. *J Dance Med Sci.* 2001;5(4):115.
3. Lee SA. Adolescent issues in a psychological approach to dancers. *J Dance Med Sci.* 2001;5(4):121-126.
4. Krasnow D, Mainwaring LM, Kerr G. Injury, stress and perfectionism in young dancers and gymnasts. *J Dance Med Sci.* 1999;3(2):51-58.
5. National Association of Schools of Dance Handbook. 2001:86-107.
6. Cardinal MK, Hilsendager SA. A curricular model for dance wellness education in higher education dance programs. *J Dance Med Sci.* 1997; 1(2):67-72.

Gayanne Grossman, PT, MEd is the physical therapist for NovaCare's Temple University Dance Medicine Clinic, Muhlenberg College Department of Theatre and Dance, and a physical therapy consultant for the Princeton Ballet School. Additionally, she is affiliate faculty in Temple University Department of Dance and a visiting artist for Muhlenberg College teaching dance kinesiology for both schools.

Saxophone Player *(continued from page 13)*

33. Orzalesi M, Cook C. Pulmonary function in children with pectus excavatum. *J Pediatr.* 1965;66:898-890.
34. Derveaux L, Clarysse I, Ivanoff I, et al. Preoperative and postoperative abnormalities in chest x-ray indices and in lung function in pectus deformities. *Chest.* 1989;95:850-856.
35. Cibella F, Cuttitta G, Romano S, et al. Respiratory energetics during exercise at high altitude. *J Appl Phys.* 1999;86:1785-1792.
36. Matsuda S, Takebumi O, Iikura Y. Bronchial responses of asthmatic patients in an atmosphere-changing chamber 2. Effects of exercise at high altitude. *Int Arch Allergy Immunol.* 1995;107:402-405.
37. Kendall FP, McCreary EK. *Muscles Testing and Function.* 3rd ed. Baltimore, Md: Williams and Wilkins; 1983.
38. Butler DS, Jones MA. *Mobilisation of the Nervous System.* Melbourne: Churchill Livingstone; 1991.
39. Medoff LE. The importance of movement education in the training of young violinists. *Med Probl Perf Art.* 1999;14:210-219.
40. Richardson CA, Jull GA. Muscle control – pain control. What would you prescribe? *Manual Ther.* 1994;1:2-10.

Using Musculoskeletal Ultrasound for Diagnosing and Treating Foot and Ankle Injuries in Dancers

Jennifer M. Gamboa, MPT, OCS

INTRODUCTION

Insults to the foot and ankle are among the most commonly occurring injuries in dancers. While such injuries often respond to relative rest, anti-inflammatories, physical therapy, and technique re-education, chronic overuse injuries that defy rehabilitation are still all too common. More precise and dynamic differential diagnosis is often needed in these recalcitrant cases. Musculoskeletal ultrasound provides us with an inexpensive opportunity to assess the involved structures dynamically, to examine the relationship between the involved and surrounding structures, and to quickly compare the uninvolved with the involved extremity.

For the past several decades, ultrasound has been used to evaluate fetuses, conduct venus Doppler studies, and identify a variety of cysts and neuromas. The resolution of scanning technology has improved dramatically in recent years, however, and we can now use ultrasound to assess musculoskeletal anatomy. The extremities are particularly well-suited for ultrasound examination because the structures are superficial, there is very little adipose tissue, and there is minimal interference from overlying structures. The availability of high frequency transducer heads (13 to 16 MHz) means that it is possible to focus on specific muscles or tendons. One can clearly visualize the regularly arranged fibers of tendons and muscles and the border of synovial sheaths as well as study the relationship of various structures to each other. Structures can quickly be viewed longitudinally as well as in cross-section. With the addition of color power Doppler, one can see whether or not an area of chief complaint has increased blood flow, which is often evident in cases with chronic inflammation or a long-standing injury that is beginning to heal. Simultaneous video recording allows clinicians to analyze how the site of chief complaint responds to active range of motion, with and without resistance, as well as, compare motion to the uninvolved side.

Perhaps the power of musculoskeletal ultrasound as a diagnostic tool is best demonstrated through the discussion of several case reports.

CASE 1

Relevant History

In this first case, the patient was a 16-year-old female, elite preprofessional ballet dancer who trained 3 to 5 hours per day at a boarding school for classical ballet dancers. Her past history included a fracture at the base of her right fifth metatarsal, and her current chief complaint was chronic right lateral ankle pain. She had taken anti-inflammatories and undergone physical therapy for 6 months with little appreciable change in her chief complaint. Her ballet function was significantly limited due to pain in demi-pointe (heel rise to metatarsal break), full pointe (heel rise to tips of phalanges), and winging (plantar flexion with eversion).

Relevant Tests and Measures

This patient's physical exam revealed active range of motion and strength that was within normal limits and pain with resisted plantar flexed eversion. She had maximum tenderness posterior to the fibula, approximately 2 centimeters above the lateral malleolus, with minimal swelling evident. Her x-ray findings suggested an intra-articular os fibulari, which did not coincide with the site of the patient's chief complaint. Her MRI findings suggested an intra-articular avulsion fracture of the tip of the fibula (which again did not coincide with her site of chief complaint) and there was no evidence of a tear. It was at this point that a musculoskeletal ultrasound was obtained.

Ultrasound Findings

In the longitudinal view, the muscle fibers and tendons had normal parallel striations. There was minimal evidence of edema, and there were no restrictions (impingements) to active plantar flexion and eversion. In this case, the interesting findings occurred in the transverse (cross-sectional) view. Figure 1 is a transverse view of the peroneus longus and brevis distal to the lateral malleolus. What is evident here is the normal relationship between the longus and brevis. The tendons look like two noodles resting side-by-side. Figure 2 demonstrates the transverse view of the same longus and brevis tendon immediately posterior to the lateral

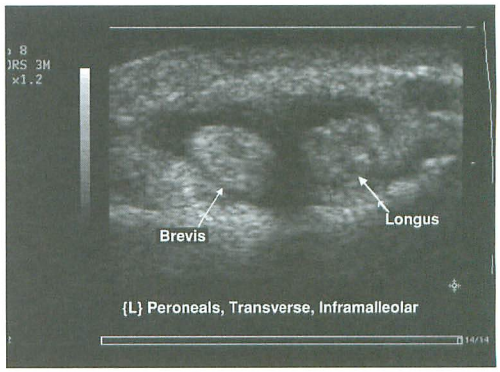


Figure 1. Normal findings eroneus longus and brevis, transverse view.

malleolus. The noteworthy finding here is that the brevis and longus are no longer resting side by side, but rather the brevis is wrapped around the longus. The dynamic findings were even more revealing. During active range of motion testing under ultrasound examination, the brevis clamped around the longus during plantar flexion. These findings are consistent with a longitudinal tear of the peroneus brevis that was not visualized with an MRI.

Treatment/Outcomes

This patient underwent retubularization of the peroneus brevis, and was back to her full dance load within 6 months without any symptoms.

CASE 2

Relevant History

In this second case, the patient was a 41-year-old female ballet dancer who took ballet class 3 to 4 times per week. Her past history included left Achilles tendonitis and significant bilateral bunion formation. Her current chief complaint was chronic left medial ankle pain during ballet activities. She had taken anti-inflam-

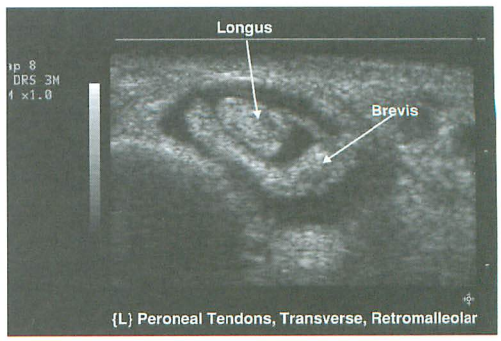


Figure 2. Longitudinal tear of the peroneous brevis, transverse view.

matories, undergone physical therapy, and then undertaken complete rest from dance for more than 6 months with little appreciable change in her chief complaint. Her ballet function was limited due to pain in demi-pointe (heel rise to metatarsal break) and with any single leg balance activities.

Relevant Tests and Measures

This patient's physical exam revealed active range of motion that was within normal limits, but she had decreased strength in her left foot and ankle, particularly in her left flexor hallicus longus tendon. She had pain with resisted first ray flexion, but no triggering was evident. This patient also had maximum tenderness posterior to the medial malleolus and there was moderate swelling present. Her x-ray findings were normal and her MRI findings suggested a tenosynovitis of the left flexor hallicus longus. Since this patient had already been treated for tenosynovitis without success, an ultrasound study was obtained to rule-out additional pathology.

Ultrasound Findings

In this case, the longitudinal findings were most relevant. Figure 3 clearly illustrates the amount of fluid collected within the synovial sheath, confirming the diagnosis of tenosynovitis. What cannot be appreciated here, but was evident during the examination itself was that during active plantar flexion, there was a positive folding sign of the FHL. In other words, the FHL fibers did not glide smoothly back and forth across the screen, but rather folded up accordion-

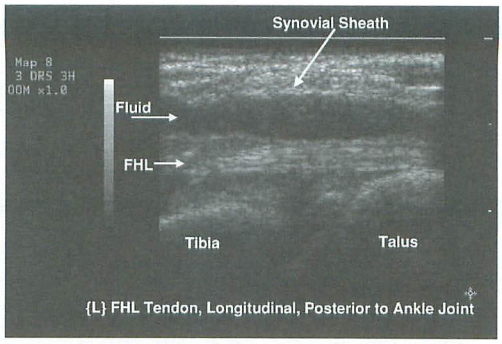


Figure 3. Tenosynovitis flexor hallicus longus, longitudinal view.

style. This positive folding sign suggested an impingement, and closer examination of the ultrasound identified a bony ossicle over which the FHL was impinging.

Treatment/Outcomes

In this case, the bony ossicle was surgically removed. The patient continued with anti-inflammatories and 2 weeks of physical therapy. The patient was back to full dance activities without pain within 8 weeks of surgery.

CONCLUSIONS

Musculoskeletal ultrasound can be a powerful diagnostic tool that is a less expensive alternative to an MRI. It also can be used to challenge or clarify the results of an MRI. The biggest advantages of ultrasound are the ability to assess active range of motion and to quickly compare the involved to the uninvolved side. In order for ultrasound imaging to be effective, however, it must be used as an extension of the clinical exam. This means that the radiologist must be adept at stress testing ligaments, muscles, and tendons or a clinician must be present during the exam. Currently, the primary disadvantage to musculoskeletal ultrasound in this county is lack of accessibility. There is a steep learning curve for the radiologist, and many are not trained in musculoskeletal ultrasound and dynamic testing. My experience in the Northern Virginia/Washington, D.C. metropolitan area, however, has been that as this diagnostic tool gains popularity, accessibility has dramatically improved over the last 3 years.

ACKNOWLEDGEMENTS

Peter A. Lavine, MD, Washington, D.C.; Brian R. Kincaid, Open MRI of Chicago; Lew Schon, MD, Baltimore, MD; Ultrasound Associates, Alexandria, VA; Washington Radiology, Washington, D.C.

SUGGESTED READINGS

1. Chhem RK, Kaplan PA, Dussault RG. Ultrasonography of the musculoskeletal system. *Radiol Clinics North Am.* 1994;32(2):275-289.
2. Kaplan PA, Anderson JC, Norris MA, Matamoros A. Ultrasonography of post-traumatic soft-tissue lesions. *Radiol Clinics North Am.* 1989;Vol 27(5):973-982.
3. Van Holsbeeck M, Introcaso JH. Musculoskeletal ultrasonography. *Radiol Clinics North Am.* 1992; 30(5):907-925.

Jennifer M. Gamboa, MPT, OCS is Director of Physical Therapy and Fitness Services at Body Dynamics, Inc in Arlington, VA. Jennifer can be reached via email at Jenn526@aol.com.

The State of Research in Dance Medicine

Sheyi Ojofeitimi, MPT, Shaw Bronner, PT, MHS, OCS

INTRODUCTION

Dance medicine is in relative infancy compared to orthopaedic and sports medicine. In terms of research, dance medicine practitioners are making strides, but much work remains to be done. This article is the first section of a multi-part assessment of dance medicine research (Table 1). Our purpose is to present a review of dance medicine research and suggest areas for future efforts. Dance medicine will be related to a sports medicine model throughout this paper, as a roadmap for the past and future.

The Performing Arts Special Interest Group (PASIG) recently underwent a practice analysis in which a general consensus emerged that dance medicine practitioners followed a sports medicine model. This included the areas of preseason screening; definitions of injury; team approach to coverage, treatment, and integration of the professional dancer with the organization or dance company. To date, much of our time and emphasis has been focused on the clinical evaluation and treatment of dance injuries. At the Combined Sections Meeting 2002, part of the PASIG programming was devoted to presentation of dance case studies as an important contribution to the analysis of standards of best practice. Similarly, in the early years, sports medicine focused on clinical medicine and surgery. In the 1960s, sports medicine began a transitional change into 3 specific areas of research: epidemiology of sports injury, biomechanical analysis of sports movements, and outcomes measures development and study.

This evolution on the part of sports medicine permitted scientists and clinicians to redefine the way they conducted research and produced information relevant to clinical treatment. The systematic application of this model to a defined population has allowed more efficient and effective treatment and training, prevention of injury, and extension of the athlete's career. Application of this model to dance medicine can yield similar benefits.

EPIDEMIOLOGY

In sports medicine, epidemiology contributes systematic application of (1) surveillance systems, (2) data collection and analysis, (3) determination of risk factors, (4) implementation of intervention, and (5) re-evaluation of program effectiveness, to the sports population. A discussion of these components follows.

Standards of Injury Surveillance

The epidemiologic approach to devising surveillance systems to detect injury occurrence was an important development in sports medicine research. Improved data collection was useful to document the incidence, magnitude, and pattern of injury thus identifying high-risk groups and generating hypotheses of injury risk factors. This was the first step toward implementing change in sports medicine.

One of the strengths in dance and sports medicine research is the description of patterns of injury. However, lack of standardized and clearly defined terminology has complicated comparison of injury rates within both the sports and dance medicine literature. Currently there is no widely accepted definition of what constitutes an *injury*. The US National Athletic Injury Registration System defined injury as reportable if it limits participation for at least one day following the injury.[1] Other sports definitions are more stringent, specifying one or more criteria including: absence from training or game(s), need for medical treatment, and diagnosis of tissue damage.[2] A time loss definition of injury may underestimate injuries in organizations with low frequency of training and games. However, this definition of injury, that includes time loss and medical treatment criteria, is similar to that of the US Occupational Safety and Health Administration (OSHA).[3] The OSHA definition of recordable occupational injury includes: injuries that result in restriction of work or motion, lost time, or require medical treatment beyond first aid.[3]

Adopting a commonly accepted definition of injury is the first of many criteria necessary to develop a standardized system for surveillance. Other criteria include definition of the population, exposure to the activity, severity, and anatomic region of injury. Without a universally accepted methodology, injury rates may be artificially inflated or deflated, depending on the bias. For example, descriptive studies that report on injuries seen within one clinic may deflate the true incidence, as they cannot define the complete population at risk. Who reports the injury (dancer vs. medical personnel) and when the injury is reported (retrospective vs. prospective report) affects the calculation of injury incidence. A dancer's self-report may include aches and pains that still allow them to dance thus inflating injury reports, while medical personnel may use a more stringent standard and reduce injury rates. Retrospective questionnaires have been shown to deflate the true incidence compared to prospective weekly surveillance systems.[4] Less than one third of moderate and 10% of minor injuries were

Table 1. Outline of Dance Medicine Research

I. EPIDEMIOLOGY
- A. Standards of Injury Surveillance
- B. Risk Factors
  - 1. *Intrinsic Risk Factors*
    - i. Profiling through screening
    - ii. Nutrition and menarche
    - iii. Strength
    - iv. Age and growth
    - v. History of injury
    - vi. Cardiovascular conditioning
    - vii. Joint laxity and flexibility
    - viii. Psychological factors
    - ix. Crosstraining
  - 2. *Extrinsic Risk Factors*
    - i. Technical demands
    - ii. Style of dance
    - iii. Environmental conditions
    - iv. Activity
    - v. Shoes and costumes

II. BIOMECHANICS
- A. Postural control
- B. Plié
- C. Passé
- D. Développé Devant
- E. Arabesque
- F. Jumping

III. OUTCOMES
- A. Orthopaedic measures
- B. DFOS
- C. Work-related measures

remembered retrospectively in a comparison study of data collection methods. Also important in any discussion of injury incidence and patterns is the definition of severity and type of injury. Several time-based definitions of *severity* exist in the literature including: *minor* (less than one week), *moderate* (1 to 4 weeks), and *severe* (more than 4 weeks).[4] Specific definition of injury type (overuse v. traumatic) and anatomic region should be included to permit analysis of patterns of injury.

Reporting *exposure* to the sport is an important way to relate injury to time on task. We must begin to describe dance exposure by developing stringent records concerning the number of contracted weeks of employment, hours of dancing per week, number of performance or rehearsal weeks, total number of performances, and number of touring weeks. For example, in our recent paper *Injuries in a Modern Dance Company: Effect of Comprehensive Management on Incidence and Time Loss*, the company dancers' annual contract averaged 41 ± 2.6 weeks, with 10 ± 0.5 rehearsal weeks of new choreography and 27 ± 2.9 weeks spent on tour.[5] They danced an average of 1644 ± 102 hours annually, which included 180 ± 19 performances. Sports researchers recommend injury incidence be studied in entire year blocks that include preseason training.[4] To allow comparison of injury rates between populations, exposure measures are incorporated into injury incidence calculations. In sports, this is defined as the number of injuries per 1000 hours of sports participation.[1] Dance injuries at Alvin Ailey ranged from 18.3 (Year 2) to 6.8 (Year 5) injuries per 1000 dance hours.[5] In comparison, injury rates in sports ranged from 1.4 injuries per 1000 training hours in figure skaters,[6] to 6.2 to 7.3 per 1000 exposure hours in male soccer players.[4,7]

In any surveillance system it is important to include contextual information about the injury. This includes venue (indoor, outdoor, raked, or nonraked stage), choreography (style, specific ballet), and activity (class, rehearsal, or performance). This information helps to explain the relationship of exposure (dancing 20 hours/week vs. 40) and type of workload to injury. Implementation of standards of definition and reporting will permit comparison of one dance population to another or dance to various sports injuries (Appendix 1). This is an important step to differentiating risk factors for injury.

Risk Factors

Risk factors are attributes or elements that predispose an individual to injury and can be classified as either *intrinsic* or *extrinsic*. *Intrinsic* risk factors are player-specific physical characteristics such as skeletal asymmetries, joint laxity, physical fitness (strength, coordination, flexibility), age, gender, psychological factors, and previous history of injury. *Extrinsic* risk factors include type of sport, playing time (exposure), level of competition, training errors, equipment, and environmental conditions. To date, only a few studies have examined the relationship of risk factors to specific dance injuries. A discussion of dance specific intrinsic risk factors follows.

Intrinsic Risk Factors

Intrinsic risk factors in dance include anthropometrics, fitness, gender, age, and history of injury. The annual preseason team screenings are an important mechanism in sports for developing population profiles for norms for healthy elite college and other age athletes. Through correlating screening results with injury, hypotheses on intrinsic risk factors are developed, theories are tested through intervention, and conclusions are developed.

Profiling through screening

Preseason screens are traditionally used when 'healthy' athletes return to practice to identify intrinsic risk factors for musculoskeletal injury. Preventative measures can then be initiated (stretching, strengthening, etc.) to decrease the risk factors. Dance screens are useful tools in injury prevention. They provide healthy baseline data, uncover pathology, and help develop characteristics for a given level of performance. To date, screens have been used primarily in professional and student dance populations to develop a dance profile in comparison to the nondance population. If a dancer lies outside those dance 'norms,' practitioners make recommendations to bring their results more in line with those of the group. While there is no question about the value of such information, dance medicine must aim to move beyond the descriptive report of screens or incidence of injury to an understanding of the risk factors for injury, and ultimately, injury prevention. For example, Hamilton et al[8] reported that total injuries and overuse syndromes were more common in female ballet dancers with less turnout and less plié. Does less dorsiflexion in a plié play an important role in the development of shin splints and other overuse injuries related to jumping? This report was not specific in delineating the types of injuries related to these findings.[8] Correlation of screening results with injury, implementation of preventative cross training programs, and subsequent follow up screenings will determine whether current cross training programs are effective in preventing injuries.

There is a need to adopt standardized screening methods to allow researchers to develop larger databases in order to systematically compare populations.[9] Additionally, there is a need to adopt screening tools that measure functional capacity in dancers. Suggestions and models for such tools already exist,[10,11] but need to be universally agreed upon, and implemented.

Nutrition and menarche

There are extensive reports in both the sports and dance medicine literature on the female athlete triad (disordered eating, amenorrhea, and osteoporosis). Excessive training, with concurrent dietary restriction and low body mass index, can be associated with reduced bone mineral density, delayed menarche, subsequent menstrual dysfunction, and increased risk of stress fractures.[12-18] The competitive and aesthetic nature of dance compels dancers to pursue training and nutrition strategies that predispose them to fatigue, decreased neuromuscular control, and altered forces throughout the musculoskeletal system. Dancers demonstrate increased incidence of anorexia, menstrual dysfunction, scoliosis, osteoporosis, and stress fractures.[12,14,15,18-21] Menarche is postponed by an average of 3 years and 24% to 50% of female dancers have scoliotic curves, compared to 3.9% in the general population.[4,18] Intensive dance training has also been shown to have repercussions on growth and puberty.[17,22,23] Although studies are extremely limited, preventative and intervention programs show encouraging results in reducing restricted eating in this high-risk population.[23] These studies point to the need for improved education of dancers, teachers, choreographers, and parents and suggest the need for counseling services in dance schools.

Strength

Several studies describe 'strength' ratios (isokinetic torque) in dancers;[8,24-26] however, they lack sufficient numbers and agreement to establish strength 'norms' within the dance population. One study reported higher dorsiflexion and plantarflexion strength and unaltered ratios in both male and female elite ballet dancers compared to norms of other athletes.[8] Two other studies reported

decreased dorsiflexion strength and altered plantar/dorsiflexion ratios, which they suggested predispose dancers to injury.[25,27] Researchers reported normal quadriceps/hamstrings ratios (1.6 - 2.0) in dancers,[8,28] but weakness in quadriceps (-16%) and hamstrings (-18%) in male dancers compared to other male athletes.[8] Hamilton and colleagues[8] also found a marked imbalance between hip abduction (+20%) and adduction (-25%) strength resulting in reversal of the normal ratio of .70 to 1.2 in both male and female ballet dancers. What remains unclear is whether these changes are a result of specific adaptation to the demands of dance which are beneficial, or are risk factors for injury that need to be addressed. A prospective study of ankle injury risk factors by Baumhauer et al[29] reported greater eversion to inversion strength ratios in athletes who later sustained ankle sprains compared to uninjured athletes. They also found a higher incidence of inversion ankle sprains in athletes with greater plantar flexion strength and smaller dorsiflexion to plantar flexion ratios. Similar studies establishing healthy strength norms and correlating deviation from these norms with injury are necessary within the dance population.

Age and growth

Several sports and dance reports suggest that older age is a risk factor for injury.[30-33] Carvajal and colleagues[34] noted that dancers who began instruction at a later age were at higher risk of injury. In contrast, younger dancers accounted for the greatest incidence of injury as well as the greatest number of injuries per dancer in both a modern dance and a ballet company.[5,35] In one company, younger dancers represented only 29% of the population of dancers but were responsible for 35% to 45% of new injuries.[5] This finding suggests that younger dancers may require some sort of transitional program to assist them in managing the new stresses of professional dance.

Authors agree that adolescent growth spurt is a physiological risk factor in sports and dance injuries.[36-38] The immature musculoskeletal system is less resistant to repetitive microtrauma than adult cartilage.[36] The damage incurred as a result of repetitive microtrauma in growing children can be irreversible,[39] and symptoms may not manifest until later in life. Additionally, asynchronous musculoskeletal growth (bones grow faster than soft tissues) results in increased tightness of soft tissues.[40,41] Young dancers often complain of loss of flexibility during the growth period. Attempts to forcibly improve flexibility during this period put the younger dance at greater risk of injury. Authors suggest that increases in intensity and duration of training during this period should be done slowly to allow the dancer to gain coordination over their changing bodies.[40,41]

History of injury

Sports medicine research has demonstrated that history of ankle injury is a strong predictor for subsequent ankle injuries.[42-44] McKay et al[44] found that basketball players with history of ankle injury were almost five times more likely to sustain another ankle injury. Similarly, dance medicine research shows that dancers who sustain one injury during a season are more likely to sustain another injury during the same season.[35,45] Garrick and Requa[45] reported that out of 104 injured dancers, 24 sustained 5 or more injuries each. These 24 dancers averaged 6.7 injuries each versus 1.86 average injuries for the remaining injured dancers. Solomon and colleagues found that 7 dancers (out of a population of 60 dancers) averaged 4.6 injuries each, accounting for 23% of the total injuries.

Cardiovascular conditioning

The Compendium of Physical Activities, a coding scheme that classifies specific physical activity by rate of energy expenditure, lists metabolic equivalent (MET) intensity levels of 0.9 (sleeping) to 18 (running at 10.9 mph). The MET intensities for 'dancing' range from 3.0 (waltz, foxtrot, slow dancing) to 10.0 (aerobic, with 0 - 12 inch step), with ballet and modern dance at 4.8.[46] Based on a 4.8 MET level, ballet and modern dance would be considered moderate intensity (3-6 METs) activities. However, energy requirements of ballet or modern exercise vary throughout class.[47,48] Cohen and colleagues[47] reported MET levels of 5.25 and 4.86 in males and females respectively during barre exercises compared to 7.52 and 5.73 during center floor exercises. They classified barre exercise as moderate intensity and center floor exercise as heavy intensity work; however, they used a different MET standard[49] from that of Ainsworth et al.[46]

General consensus is that the static component of modern and ballet exercise combined with the intermittent burst of sprint-like activity of center and across the floor dancing stimulates only modest aerobic capacity, thereby producing VO_{2max} values within the range of non-endurance athletes.[28,47,48,50-53] Review of the literature suggests that aerobic capacity values in dancers have remained the same over the years, indicating that there has been no trend in emphasizing aerobic training in dancers. A literature search revealed no studies examining the relationship between cardiorespiratory fitness levels and incidence of injury. Nor did it reveal any effect of endurance training on performance. Additionally, no studies were found comparing aerobic demand during class and rehearsal to those of performance. We need to know whether dance training adequately prepares dancers for the aerobic demands of staged performances. We also need to know what level of endurance training leaves a dancer at most and least risk for injury.

Joint laxity and flexibility

Several studies have shown an increased prevalence of arthrosis in the knees, ankles, and first metatarsalphalangeal (MTP) joints in former professional dancers compared to age-matched nondancers, but no association with hypermobility.[54,55] Examination of range of motion of lower extremity joints found increased hip flexion, abduction, and external rotation, ankle plantarflexion, subtalar inversion and eversion, and MTP dorsiflexion hypermobility.[54,55] Hamilton et al[8] examined professional ballet dancers and found flexibility scores placed them in the hypermobile range, but declared them flexible not hypermobile. They demonstrated increased hip external rotation at the expense of internal rotation, hip abduction at the expense of adduction, increased hip flexion, and plantarflexion with a loss of dorsiflexion. Other authors, using the Beighton hypermobility criteria, found 4% to 10% of ballet students and professionals demonstrated generalized joint hypermobility compared to age-matched controls.[56,57] Injuries were more common in the hypermobile group.[57]

Psychological factors

Several researchers have examined the role of emotional and psychological factors in dance injuries.[31,58,59] Mainwaring and colleagues[58] reported a direct correlation between negative stress and duration of injury and an inverse correlation between positive stress and duration of injury. Patterson et al[59] noted that while negative life events were unrelated to injury among dancers who reported high levels of social support, it accounted for nearly 50% of the injury variance in dancers who reported low levels of social support in their lives. Hamilton and colleagues[31] found personality characteristics suggestive of the *overachiever*, combined

with physical stress, characterized dancers who had experienced the greatest number of injuries throughout their career. They concluded that the qualities necessary in the dancers' continual drive toward physical perfection can also lead to a history of chronic injuries if carried to an extreme. These studies show that psychosocial factors cannot be ignored when considering the injury process in dance.

Cross training

Dancers commonly believe that in order to improve as dancers, they need to dance more. While this is in agreement with the SAID (specific adaptation to imposed demand) principle, *overtraining syndrome* can lead to profound difficulties in maintaining peak performance. Overtraining syndrome has been qualified as a "neuroendrocrine disorder characterized by poor performance, inability to maintain training loads, persistent fatigue, frequent illness, disturbed sleep and alterations in mood state."[60] Alternatively, studies show that dancers can enhance their performance through conditioning and reduce risk of injury through cross training.[61-63] Pilates-based training has been shown to result in less upper body sway, improved body alignment,[62] and functional improvements in leaping ability.[64] A back strengthening program increased lumbar extensor strength 14% to 151%, with a functional increase in arabesque height and reduction in number of missed classes and rehearsals.[63] A 6-week period of specifically targeted iliopsoas strengthening resulted in increased height of the dèveloppé à la seconde.[61] Somatic training also shows promise as an intervention in postural alignment.[65]

CONCLUSION

Dance medicine research continues to evolve. While there is a plethora of information on dance epidemiology, many of these studies are descriptive reports. Dance medicine must move beyond the descriptive report of screens or incidence of injury to an understanding of the risk factors for injury in order to develop effective and efficient prevention programs. Prospective cohort designs, which screen and then follow the cohort for 1-year, will allow calculation of risk of injury for various subgroups. Randomized, controlled clinical trials should be the method of choice to evaluate the effectiveness of specific prevention and other intervention programs.

The small sample size of various dance populations remains a problem in achieving sufficient power in research. The solution lies in developing a standardized surveillance system and an extensive dance injury registry. Adopting commonly accepted definitions of injury, population, exposure to the activity, severity, and anatomic region of injury are the first of the steps necessary to develop a standardized system for surveillance. Implementation of standards of definition and reporting will permit comparison of one dance population to another, an important step to differentiating risk factors for injury. In a subsequent article we will review dance research in the areas of Epidemiology: Extrinsic Risk Factors, Biomechanics, and Outcomes.

Appendix 1. Dance Injury Surveillance System

A. Demographics

- Year (of data collection)
- Name (code)
- Status (company)
- Gender
- Age
- Age began training
- # years of dance training
- # years professional
- # years in company

B. Injury Report

- Date of Injury
- Body part
- Diagnosis
- Trauma / Overuse
- Mechanism of Injury
- Activity (rehearsal, performance, class, other)
- Choreography (name of piece / style)
- Indoors / outdoors
- Raked / non-raked stage
- # performance days missed
- # work days missed (including performance, class, rehearsal)
- Workers Compensation case opened (yes/no)
- Medical expense

C. Annual Exposure Report

- Year (of collection)
- # dancers
- # contract weeks
- # rehearsal weeks
- # performance weeks
- # tour weeks
- # performances
- # hours dance / week

Note: exposure may change depending on status in company (principal, soloist, etc)

REFERENCES

1. van Mechelen W, Hlobil H, Kemper HCG. Incidence, severity, aetiology and prevention of sports injuries. A review of concepts. *Sports Med.* 1992;14:82-99.
2. Dvorak J, Junge A. Football injuries and physical symptoms: A review of the literature. *Am J Sports Med.* 2000;28(5):S3-9.
3. OSHA Record Keeping Guidelines, Appendix A. Glossary of terms. Occupational Safety & Health Administration, US Dept of Labor. Washington DC: Government Printing Office; 1999.
4. Junge A, Dvorak J. Influence of definition and data collection on the incidence of injuries in football. *Am J Sports Med.* 2000;28(5):S40-46.
5. Bronner S, Ojofeitimi S, Rose D. Injuries in a modern dance company: Effect of comprehensive management on incidence and time loss (unpublished data).
6. Kjaer M, Larsson B. Physiological profile and incidence of injuries among elite figure skaters. *J Sports Sci.* 1990;10:29-36.
7. Morgan BE, Oberlander MA. An examination of injuries in major league soccer. *Am J Sports Med.* 2001;29(4):426-430.
8. Hamilton WG, Hamilton LH, Marshall P, Molnar M. A profile of the musculoskeletal characteristics of elite professional ballet dancers. *Am J Sports Med.* 1992;20(3):267-273.
9. Clippinger KS. Editorial: Dance screening. *J Dance Med Sci.* 1997; 1(3):84.
10. Bronner S, Turner R. The Dance Functional Outcome System: A new measurement tool. *J Orthop Sports Phys Ther.* 1999;29(1):A-20.
11. Liederbach M. Screening for functional capacity in dancers designing standardized, dance-specific injury prevention screening tools. *J Dance Med Sci.* 1997;3:93-106.
12. Frusztajer NT, Dhuper S, Warren MP, et al. Nutrition and incidence of stress fractures in ballet dancers. *Am J Clin Nutr.* 1990;51:779-783.
13. Highet R. Athletic amenorrhea: An update on aetiology, complications and management. *Sports Med.* 1989; 7:82-108.

14. Kadel NJ, Teitz CC, Kronmal RA. Stress fractures in ballet dancers. *Am J Sports Med.* 1992;20:445-449.
15. Keay N, Fogelman I, Blake G. Bone mineral density in professional female dancers. *Br J Sports Med.* 1997;31:143-147.
16. Lloyd T, Buchanan JR, Bitzer S, et al. Interrelationships of diet, athletic activity, menstrual status and bone density in collegiate women. *Am J Clin Nutr.* 1987;46:681-684.
17. Valentino R, Savastano S, Tommaselli AP, et al. The influence of intense ballet training on trabecular bone mass, hormone status, and gonadotropin structure in young women. *J Clin Endocrinol Metab.* 2001;86(10): 4674-4678.
18. Warren MP, Brooks-Gunn J, Hamilton LH, et al. Scoliosis and fractures in young ballet dancers. Relation to delayed menarche and secondary amenorrhea. *N Engl J Med.* 1986; 314:1348-1853.
19. Brooks-Gunn J, Warren MP, Hamilton LH. The relation of eating problems and amenorrhea in ballet dancers. *Med Sci Sports Exerc.* 1987;19(1):41-44.
20. Warren MP. Effects of undernutrition on reproductive function in the human. *Endocr Rev.* 1983;4(4):363-377.
21. Warren MP. Femoral head collapse associated with anorexia nervosa in a 20-year-old ballet dancer. *Clin Orthop Rel Res.* 1990;251:171-176.
22. Pigeon P, Charlet OI, Rochiccioli P. Intensive dance practice. Repercussion on growth and puberty. *Am J Sports Med.* 1997;25(2):243-247.
23. Yannakoulia M, Matalas A-L. Nutrition intervention for dancers. *J Dance Med Sci.* 2000;4(3):103-108.
24. Calé-Benzoor M, Albert M, Grodin A, Woodruff LD. Isokinetic trunk muscle performance characteristics of classical ballet dancers. *J Orthop Sports Phys Ther.* 1992;15(2):99-105.
25. Liederbach M, Hiebert R. The relationship between eccentric and concentric measures of ankle strength and functional equinus in classical dancers. *J Dance Med Sci.* 1997;1:55-61.
26. Parnianpour M, Davoodi M, Forman M, et al. The normative database for the quantitative trunk performance of female dancers: Isometric and dynamic trunk strength and endurance. *Med Probl Perform Art.* 1994;9:50-57.
27. Nissonson B, Liederbach M, Nicholas J. Comparisons of ankle strength ratios between ballet dancers, soccer player, and football players. *Proceedings*, VI[th] Annual Symposium on Medical Problems of Musicians and Dancers. 1988:Abstract 44.
28. Koutedakis Y, Myszkewycz L, Soulas D, et al. The effects of rest and subsequent training on selected physiological parameters in professional female classical dancers. *Int J Sports Med.* 1999;20:379-383.
29. Baumhauer JF, Alosa DM, Renström AFH, et al. A prospective study of ankle injury risk factors. *Am J Sports Med.* 1995;23(5):564-570.
30. Evans RW, Evans RI, Carvajal S. A survey of injuries of Broadway performers. *Am J Public Health.* 1996;86:77-80.
31. Hamilton LH, Hamilton WG, Meltzer JD, et al. Personality, stress and injuries in professional ballet dancers. *Am J Sports Med.* 1989; 17:263-267.
32. Lysens R, de Weerdt W, Nieuwboer A. Factors associated with injury proneness. *Sports Med.* 1991;12:281-289.
33. Watson AWS. Sports injuries: Incidence, causes, and prevention. *Phys Ther Rev.* 1997;2:135-151.
34. Carvajal SC, Evans RI, Evans RW, et al. Risk factors for injury in the career female dancer: An epidemiologic study of a Broadway sample of performers. *Med Probl Perform Art.* 1998;13:89-93.
35. Solomon R, Micheli LJ, Solomon J, et al. The "cost" of injuries in a professional ballet company: Anatomy of a season. *Med Probl Perform Art.* 1995;10:3-10.
36. Micheli LJ, Klein JD. Sports injuries in children and adolescents. *Br J Sports Med.* 1991;25(1):6-9.
37. Phillips C. Strength training of dancers during adolescent growth spurt. *J Dance Med Sci.* 1999;3(2):66-72.
38. Poggini L, Lasasso S, Iannone S. Injuries during the dancer's growth spurt: Etiology, prevention and treatment. *J Dance Med Sci.* 1999; 3(2):73-79.
39. Blimkie CJR, Bar-OR O. Trainability of muscle strength. Power, and endurance during childhood. In: Bar-Or O, ed. *Child and Adolescent Athlete.* London: Blackwell Science; 1996: 113-129.
40. Gerrard DF. Overuse injury and growing bones: The young athletes at risk. *Br J Sports Med.* 1993;27(1):14-18.
41. Micheli LJ. Overuse injuries in children's sports: The growth factor. *Orthop Clin North Am.* 1983; 14(2):337-360.
42. Bahr R, Bahr IA. Incidence of acute volleyball injuries: a prospective cohort study in injury mechanism and risk factors. *Scan J Med Sci Sports.* 1997;7:166-71.
43. Ekstrand J, Tropp H. The incidence of ankle sprains in soccer. *Foot Ankle.* 1990;11:41-44.
44. McKay GD, Goldie PA, Payne WR, et al. Ankle injuries in basketball: injury rate and risk factors. *Br J Sports Med.* 2001;35(2):103-108.
45. Garrick JG, Requa RK. Ballet injuries: an analysis of epidemiology and financial outcome. *Am J Sports Med.* 1993;21:586-590.
46. Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of physical activities: An update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000;32(9):S498-S516.
47. Cohen JL, Segal KR, Witrol I, McArdle WD. Cardiorespiratory responses to ballet exercise and the VO_{2max} of elite ballet dancers. *Med Sci Sports Exerc.* 1981;14(3):212-217.
48. Schantz PG, Åstrand P. Physiological characteristics of classical ballet. *Med Sci Sports Exerc.* 1984;16(5):472-476.
49. Durnin JVGA, Passmore R. *Energy, Work and Leisure.* London: Heinemanm Educational Books; 1967.
50. Åstrand PO, Rodahl K. *Textbook of Work Physiology.* 2nd ed. New York, NY: McGraw-Hill; 1977:305.
51. Dahlström M. Physical effort during dance training: A comparison between teachers and students. *J Dance Med Sci.* 1997;1(4):143-148.
52. Mostardi RA, Porterfield JA, Greenberg B, et al. Musculoskeletal and cardiopulmonary characteristics of the professional ballet dancer. *Phys Sports Med.* 1983;11(12):53-61.
53. Novak LP, Magill LA, Schutte JE. Maximal oxygen intake and body composition of female dancers. *Eur J Appl. Physiol.* 1978;39:277-282.
54. Teitz CC, Kilcoyne RF. Premature osteoarthritis in professional dancers. *Clin J Sport Med.* 1998; 8(4):255-259.
55. Van Dijk CN, Lim LS, Poortman A, Strübbe EH, Marti RK. Degenerative

joint disease in female ballet dancers. *Am J Sports Med*. 1995;23(3):295-300.

56. Grahame R, Jenkins JM: Joint hypermobility - asset or liability? *Ann Rheum Dis*. 1972;31:109-111.
57. Klemp P, Chalton D. Articular mobility in ballet dancers:A follow-up study after four years. *Am J Sports Med*. 1989;17(1):72-75.
58. Mainwaring L, Kerr G, Krasnow D. Psychological correlates of dance injuries. *Med Probl Perform Art*. 1993;8:3-6.
59. Patterson EL, Smith RE, Everett JJ, et al. Psychosocial factors as predictors of ballet injuries: Interactive effects of life stress and social support. *J Sport Behav*. 1998;21(1):101-112.
60. MacKinnon LT. Special feature for the Olympics: Effects of exercise on the immune system: overtraining effects on immunity and performance athletes. *Immunol Cell Biol*. 2000;78(5):502-509.
61. Grossman G, Wilmerding V. The effect of conditioning on the height of dancer's extension in à la seconde. *J Dance Med Sci*. 2000;4(4):117-121.
62. McMillan A, Proteau L, Lebe RM. The effects of Pilates-based training on dancers dynamic posture. *J Dance Med Sci*. 1998;2(3):101-107.
63. Welsh TM, Jones GP, Lucker KD, et al. Back strengthening for dancers. A within-subject experimental analysis. *J Dance Med Sci*. 1998;2(4):141-148.
64. Hutchinson MR, Tremain L, Christiansen J, et al. Improving leaping ability in elite rhythmic gymnasts. *Med Sci Sports Exerc*. 1998;30(10):1543-1547.
65. Gamboian N, Chatfield S, Wollacott MH. Further effects of somatic training on pelvic tilt and lumbar lordosis alignment during quiet stance and dynamic dance movement. *J Dance Med Sci*. 2000;4(3):90-98.

Sheyi Ojofeitimi, MPT is Research Assistant at Soar Research in Brooklyn, NY. Shaw Bronner PT, MHS, OCS is Director of Soar Research, Associate Research Professor at Long Island University, and Director of Therapy Services at Alvin Ailey American Dance Center.

Boots, Blades, and Figure Skaters

Linda Tremain, PT, ATC

According to United States Figure Skating Association (USFSA), figure skating is the most popular winter Olympic sport. Michelle Kwan, Sarah Hughes, and Sasha Cohen drew more than 52 million television viewers during the long program at the 2002 Olympic games. These athletes inspire nearly 10,000 new skaters with their own Olympic dreams to begin skating each year.[1] As the sport of skating grows, more physical therapists are seeing many of these young athletes in their offices.

About 50% of skaters report fractures of some type with many as a result of traumatic falls on the ice.[2] Roughly half of the injuries in skating are acute and half are chronic. The low back and lower leg are injured more frequently than any other body parts. Only 10% to 30% of injuries occur because of single incidents, while 70% to 90% are from repetitive trauma and overuse. With some skaters on the ice over 20 hours per week, over training is still the most common cause of injury at all ages and levels of ability.[3] Although there can be several contributing factors to many common skating injuries, those related to poor equipment are unnecessary and far too frequent. Many of these ailments are easily preventable and certainly correctable.

THE EQUIPMENT

After selecting a coach, the next most important decision is selecting proper skating equipment. Improper choice of equipment can affect performance and also influence injury patterns. New skates and blades can cost well over $1,000 and are often replaced every 1 to 2 years as the skater grows and matures. The choices can be overwhelming and the skater often chooses a popular brand rather than purchasing the boot that is best for the individual needs of his or her foot. Guidelines for boot selection will be given throughout this article to prevent common chronic skating injuries.

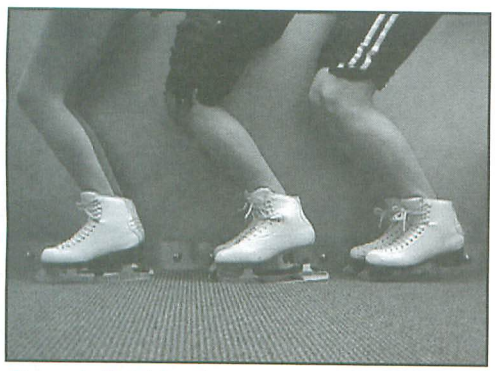


Figure 1. Notching improves ankle dorsiflexion in all 3 different brands of boots. Notice how the boot creases to allow dorsiflexion. Many skaters falsely believe that the boot is broken down and needs to be replaced when they see this crease.

The design of skating boots has changed significantly over the years. In the days of Dick Button and Sonia Henje, the leather surrounding the ankle was so soft that it folded over like a glove. The boots were hand made one by one. Now the boots are fabricated in parts or sections like building blocks and mass manufactured (some with defects). One of the most significant changes made over the years was to make the boots stiffer in order to accommodate those wanting to skate despite weak ankles.

MORE ON BOOTS

Boot Stiffness

The stiffness of the boot affects the ability of the skater to dorsiflex the ankle. Most skates only allow for 17° of total active ankle range of motion in a non-weight bearing position versus 50° with sneakers.[4] It is a common misunderstanding in the field to believe that more stiffness is required for a skater performing more difficult jumps. Remember, Dick Button did triple jumps in the late 1940s with *soft* leather boots. The stiffness of the boot should correlate with a skater's age, weight, number of hours on the ice per week, level of ability, and type of skating (freestyle, pairs, dance, precision). Skaters who are lighter, younger, spend less hours on ice per week, are beginners, and/or nonjumpers should choose softer more flexible boots. Many manufacturers make boots in double and triple stiffness for those that falsely believe that more is better. The danger of boots that are too stiff is that it prevents proper mechanics during stroking and diminishes shock absorption during landing from jumps. Stress fractures can occur in the lower leg, foot, and low back. Increased frequency of such fractures, especially in the second metatarsal head, is correlated with practice and repetition of harder jumps, such as triples and quads.[3]

What to look for: After about 3 months of wear, the skater should be able to *crease* the boot when doing a partial squat maneuver (Figure 1). If the boot prevents sufficient dorsiflexion of the ankle (Figure 2), then it will impair the ability of the skater to *get down* in the knees and get the knee over his or her toe. If shock is not properly absorbed at the ankle, then unnecessary stress is often placed at the knee or low back.

Recommendations: The ankle strength of the boot can be deleted by returning the boot to the manufacturer. Stop lacing the top lace to allow more dorsiflexion. Cut *scallops* or a notch (also Figure 1) in the leather across the top of the ankle to encourage dorsiflexion and creasing of the boot. Watch for development of the *articulated* boot currently being tested and developed by Jim Richards at the University of Delaware.

Fit

Bursitis occurs because of friction between the boot and the medial and lateral malleoli. This problem can typically be resolved by getting the boots *punched out* to allow for the normal contour of the foot and ankle. This procedure can be done at any skate shop after the skater marks the pressure points. This is a surprisingly common injury that in severe cases can result in surgery if mismanaged. Other common pressure spots include the navicular and/or the heel, often referred to as a *pump bump*. Navicular pressure points typically occur because of a pronation problem. *Pump bumps* occur when there is too much slippage of a narrow heel in the boot.

What to look for: Examine the skater's feet carefully looking for any areas of redness, chafing, inflammation, skin breakdown, calluses, and thickening. These *hot spots* reflect areas of unnecessary pressure on the heel, malleoli, or navicular bones. Inflammation of the heel typically results from too much room in the rearfoot of the boot. With normal lacing, the skater should not be able to slide the foot up and down in the boot.

Recommendations: Have the skates *punched out* at the skate shop. If the pressure persists, have the skates stretched overnight for a more aggressive correction. More serious pressure points and bursitis are often treated with aspiration, doughnut padding, and soft tissue management techniques such as various forms of massage, taping, and electrical stimulation. Dr. Mahlon Bradley, with USFSA, finds that padding must be firm in density and more aggressive than most skaters typically use in order to get relief.

Orthotics may be indicated if the stress on the medial malleoli or the navicular is a result of alignment faults such as pronation. One brand of boot, Graf, makes a heat moldable boot. After purchase, the skater heats the entire boot in the oven, puts the boot on, and allows it to conform to the contour of their foot. This helps to eliminate some pressure points that might occur in other boots. *Pump bumps* are a different problem altogether and result from too much room in the heel. These skaters might benefit from semi-custom skates that allow different widths in the forefoot and rearfoot to accommodate their foot type.

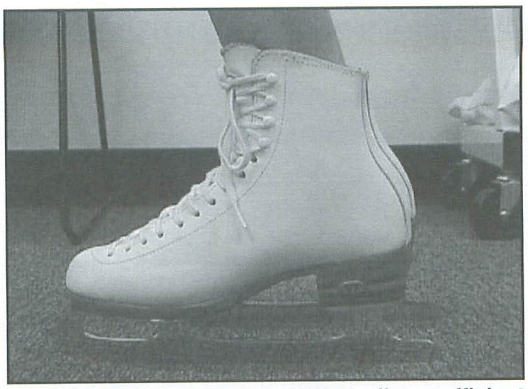


Figure 2. This boot is too stiff to allow sufficient dorsiflexion and "knee over toe" position. Cutting the boot down, skipping the top hook, and "notching" the boot will improve the dorsiflexion ability.

Boot Height

Although each manufacturer is different, typically the boot extends up the lower leg a couple of inches above the malleoli. Most often, there are 4 hooks for the skater to lace. Boots that extend too high up the leg create a long lever arm that can create unnecessary torque and stress on the tibia. Combine equipment problems with low bone mineral density, poor nutrition, and low calcium content and this can create unnecessary problems, such as stress fractures, in immature or weak bones.

What to look for: Can the skater make the boots crease while doing a partial squat maneuver? Is chafing and/or redness present on the anterior portion of the tibia from unnecessary pressure? Are they an ice dancer? The artistry of ice dancing requires the look of a pointed toe. Many ice dancers will cut the back of the boot down even more to allow for greater plantarflexion. This also helps to prevent Achilles tendonitis and irritation related to pressure.

Recommendations: Leave the top hook unlaced. Get the boots cut down to just above the second or third hook. A shorter lever arm will decrease the amount of force necessary to bring the tibia forward over the foot and ankle. These suggestions are essential for ice dancers who must perform very deep edges requiring more dorsiflexion. Cutting down the back of the boot will relieve pressure on an irritated Achilles tendon.

Lacing

Nerve compression injuries occur as a result of lacing the boots so tight that it *strangles* the nerve. The tibial and peroneal nerves can be easily compressed between the boot and the bone by this bad habit. In general, it is advisable for the laces to be most tight across the top of the ankle to help hold the foot in place in the boot, but it is not necessary to lace tightly all the way to the top. Dorsiflexion is limited and the health of the nerve is compromised from lacing too tight. This habit is often found in skaters with narrow heels who attempt to control heel slippage in the boot. It is also common in those attempting to gain additional support for weak ankles.

What to look for: If a bump or lump, which correlates with the end of the boot, is palpable when lightly tracing a finger alongside the inside or the outside of the lower leg, the skater is lacing too tight and is subject to this injury. Often these skaters will complain of tingling, pain, or cramping in various locations of the foot based on the nerve compressed.

Recommendations: Educate the skater on proper lacing to stop/prevent nerve compression. Lacing across the midfoot should be with light to moderate tension. Lacing across the ankle mortise joint should be quite firm. Lacing in the region of the hooks should be progressively looser the higher you go. For many, it may be advisable to avoid using the top hook or to cut the boot down. This will relieve the direct pressure on the vulnerable soft tissues. If the lacing habit is secondary to weak ankles, ankle strengthening may be indicated. If it is from a narrow heel, these skaters may benefit from semi-custom skates that allow for different widths of the forefoot and rearfoot. Neural mobilization, soft tissue massage, and channel padding (padding on either side of the nerve to unload tissue) may be necessary to assist the healing of these fragile tissues.

Boot Alignment

Unfortunately, manufacturing defects are not uncommon. Varus and valgus deformities occur as the leather upper is attached to the sole. These deformities can be up to 5°. When you are standing on a blade, even 1° can be significant to the skater's mechanics of stroking, jumping, and landing. The skater must be able to easily switch from inside to outside edge of the blade. It takes a keen eye to see these problems and it is not easy to quantify because sometimes there can be a twisting or torque that occurs within the boot as well. These manufacturing faults can create enormous problems up the kinetic chain from the foot to the low back. Injuries such as patellofemoral maltracking, low back pain, and ankle sprains can be exacerbated by faulty boot alignment.

What to look for: Look at the posterior view of the boot. Ignore the seams as they are often misleading and crooked. In your mind, bisect the boot and get an idea of the vertical line formed by the boot. Separately, do the same for the heel of the boot. Do these two vertical lines line up with one another or do they form a varus or valgus angle?

Recommendations: If a new boot has manufacturing defects, send it back for a new boot. Many manufacturers will deny that their product is faulty, but be persistent especially if the deformity is significant and correlates with the patient's injury. Once the new pair arrives, it would be ideal to examine the boot carefully before mounting the blade. This is where it is advantageous to purchase stock boots rather than custom made ones. Stock boots make it possible to try on and examine several pair in order to find the ones that have the best alignment. If the boot is old, it might be time for a new pair of skates. If money is an issue, it is better to get temporary skates from a second hand shop than to continue skating in a faulty pair.

Boot Weight

The weight of the boot typically increases as the stiffness increases. The brand of the boot should be selected based on the weight of the skater. Younger and more petite skaters should be cautious and avoid purchasing a brand too heavy for their frame. Older, more skeletally mature skaters with good muscle development in their lower body may be able to withstand a heavier boot. Often, the free leg has to be held in the air for extended periods. With frequent repetition of skills during practice, a heavier boot can contribute to low back pain secondary to muscular fatigue.

What to look for: Some brands, such as Harlick and Klingbeil, are heavier and stiffer than other brands like Sp-Teri, WIFA, Graf, Reidell, and Jackson. If necessary, go to the website of the manufacturer to see if the skater has purchased a

style appropriate for his or her body weight.

Recommendations: If weight of the boot is a concern, contact the manufacturer to see if they can take some of the weight out. It is possible to remove up to 20% of the weight of the boot in some brands. For rehabilitation of these athletes, therapeutic exercises should focus on building stabilizing muscles of the core and hips as well as the large power muscles, like the gluteal maximus, to help prevent fatigue of smaller muscle groups in the spine.

MORE ON BLADES

Blade Mount

Figure skating and ice dance are performed *on a circle* and this requires the skater to be on either the inside or outside edge of the skate. The blade mount is critical to the ability of the skater to be able to *hold* these edges. Even 1° of valgus or varus in the mount can cause a skater to fall unnecessarily and/or create tendonitis problems. Continual varus or valgus stress can also cause recurrent subluxations of some of the tarsal bones. Those that mount blades have different levels of experience, so the variation in mounts can be significant. Boot alignment can effect blade alignment, so both should be evaluated.

What to look for: Similar to the examination of the boot alignment, examine the relationship of the vertical line of the boot and heel (now as 1 unit) to the vertical line formed by the blade. Ideally, these two lines should form one straight line. Varus and valgus mounts contribute to pronation or supination problems. Alignment should be evaluated with the skater in and out of the boots. The skater's foot type should also be evaluated to determine how much of the alignment problem is coming from the skater and how much is from the blade mount (Figure 3).

Recommendations: Alignment problems as a result of the skater should be corrected with therapeutic exercises, taping, and/or orthotics as indicated. Alignment problems of the blade mount should be corrected by placing tiny leather shims between the heel and the blade mount to adjust or correct for any deformities. Typically only 1/32" to 1/16" corrections are necessary for deformities less than 3°. If standing on the inside edge is a result of a valgus blade mount deformity, then the shims should be placed only on the front and rear outside mounts. Write your recommendations on your business card and send it with the skater so that the skate shop can contact you with any questions.

Blade Placement

Shin splints are the most common ailment associated with improper blade placement. When properly placed, the blade should run roughly from the tip of the toe to about 1/4" shy of the end of the heel. If the blade is too short or mounted too far posteriorly, the toe pick drags in the ice and disrupts normal mechanics. Shin splints result since the blade mount will shift the center of gravity backwards.

What to look for: Check to see that the blade runs from the tip of the toe to within 1/4" of the end of the heel. Ignore the manufacturing of the sole as this can be misleading. See if the skater can roll to the ball of the foot just before the toe pick touches the ground. The most posterior toe pick should fall roughly in line with the end of the toes.

Recommendations: Get a blade appropriate for the length of the skater's foot and boot. Move the blade forward, if necessary, to allow for normal mechanics of jumping and to prevent tibialis anterior tendonitis. Although not as common, a blade mounted too far forward can cause aggravation of Achilles tendonitis. Heel height can be increased to control the distribution of weight in those suffering from chronic Achilles problems.

Blade Warp

Warping of the blade can cause a skater to lose control and contribute to various acute and chronic injuries up the kinetic chain. Most commonly, this problem arises because of new blades mounted on an unlevel boot surface and/or with asymmetry of the sole associated with rotting leather.

What to look for: Evaluate blade alignment from the rear. Compare the position of the rearfoot blade mount to the forefoot blade mount. Look for twisting between the rearfoot and forefoot. Confirm suspicions of blade warp by laying the blade on a flat surface and see if you can wobble or rock the blade on either side. Blade warp is best confirmed at the skate shop once the blade has been removed.

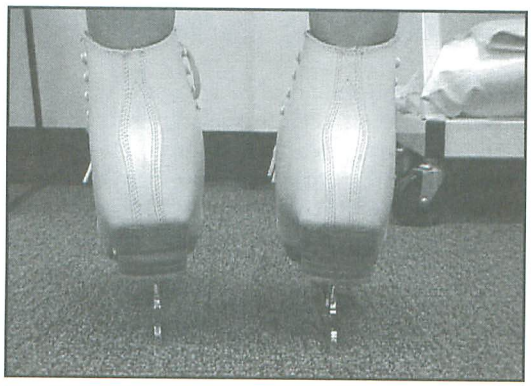


Figure 3. Careful evaluation will reveal if this alignment problem is from the boot, the blade, or the skater.

Recommendations: Warped blades must be replaced. Temporary shims can be used to balance the alignment but this is not a long-term solution. Make sure new blades are mounted on a level boot surface. Keep skates dry and use water sealant to prevent rotting of the leather.

Orthotics

Many figure skating manufacturers make orthotics and permanently mount them into the construction of the boot. This creates many problems for the therapist including the inability to determine the amount of correction present and the inability to modify the correction as foot conditions change. More ideally, the therapist, podiatrist, or physician should make the orthotics so that they can be inspected and modified as necessary.

Recommendations: Since most skates fit like a glove, there is little room for extrinsic correction. Intrinsic correction is preferable whenever possible. In fact, it is sometimes necessary to sacrifice full correction in order to fit in the boots. I have had the most success with a vinyl covered, poron padded, low volume, narrow cut, sulcus length, intrinsic posted (only) Performer made by Biomechanical Services. It is important to note that when orthotics are prescribed for ice dancers, it is necessary to make adjustments to allow for the natural slope of the heel similar to a women's dress shoe since the heel height can be more than a half inch higher than a figure skating boot. Typically, this modification is not necessary for a figure skating boot.

Many common figure skating injuries are related to faulty equipment, poor alignment, and over training. Many of these injuries are easily treatable with a few simple recommendations. Sometimes a skater can be frustrated by his or her inability to execute a skill not knowing that the equipment is at fault. Educate the skaters, parents, and coaches. Education and awareness are the first step towards change. Together with the skating community, the boot/blade manufacturers, and the skate shops, we can help to reduce common ailments that can plague a skater's career.

REFERENCES

1. United States Figure Skating Association, Fact Sheet, 20 First Street, Colorado Springs, CO. www.usfsa.org.

(continued on page 36)

Use of Electrical Stimulation to Supplement Lumbar Stabilization for a Figure Skater Following Lumbar Fusion

Tara Jo Manal, PT, OCS

Patients with low back pain can be a difficult population for the clinician to treat. The challenge increases when the patient is involved in high intensity activities such as dance, gymnastics, and figure skating. The demands on the spines of these athletes can be significant. The hallmark of a successful figure skater is a blend of grace, flexibility, and strength. The combination of skills requires the skater to jump, twist, spin, and glide in various positions including both end-range lumbar extension and flexion.

The role of lumbar muscular strength and its relationship to low back pain remains controversial.[1] In studies looking at the prediction of low back pain in manual workers and firefighters, however, there was a positive correlation between low back muscle weakness and frequency of low back pain.[2,3] These studies concluded that the weaker the low back musculature, the more likely the person was to develop low back pain. Although the evidence may be insufficient to indicate low back strengthening for all high level performing artists as a preventative measure, there is strong evidence that persons with previous back injures have lower measures of muscle strength even months or years after the injury.[4]

The low back strength deficit present following an episode of low back pain may leave an injured athlete at greater risk of reinjury. During a low back injury, a skater is likely unable to train at their regular intensity level. The time away from full practices, ballet classes, and even weight and cardiovascular training can have negative effects on their overall strength and conditioning. A therapist must be aware that restoration of strength lost since the injury may be necessary both to protect the newly injured area and to safely return a skater to the ice.

A progressive return to full skating activity can be developed as a multidisciplinary approach. Depending on the resources of the skater, a "return to skating program" may include input from the treating physician, physical therapist, rink athletic trainer, strength and conditioning coach, and ballet teacher. Information and coordination from the skater's coach is also crucial to the successful return of the injured skater. The figure skating coach is a valuable partner in the rehabilitation process. Coaches can provide technique advice and identify the in-season requirements necessary for a particular skater to return to a successful competitive season. The coach also is responsible for the implementation of the "return to skating progression" and should be involved in the approval and development of the program.

The spine is protected by a stabilization system comprised of both active and passive components.[5] The passive structures of the spine include the vertebrae, discs, facet articulations, and ligaments. The spinal musculature contributes to the active components of spinal stabilization. The two systems are interdependent and disruption of one may result in increased demands on the other system to maintain a consistent level of spinal stability. Whenever possible, the goal of lumbar muscular training is to challenge the muscular components while avoiding simultaneous stress of the passive structures of the spine.

Lumbar stabilization training is a term describing exercises aimed at creating muscular support of the lumbar spine. A wide variety of exercises are prescribed to improve muscular support in the lumbar area of patients with low back pain. McGill and colleagues have evaluated many of the low back exercises commonly used in physical therapy for patients with low back pain.[6,7] The authors rely on biomechanical evaluation to identify the exercises which both "challenge muscle and enhance performance but that are performed in such a way as to minimize loading of the spine to reduce the risk of injury exacerbation."[7]

The abdominal area is a strong supporter of the trunk during stabilization of the lumbar spine. McGill and colleagues recommend curl-ups, also known as crunches (Figure 1) for activation of the rectus abdominis muscle and isometric horizontal side support (Figure 2), also known as side planks, for the lateral obliques and quadratus lumborum muscles. These exercises have been shown to recruit high levels of muscle activity without creating high compressive forces on the spine. Lumbar extensors provide

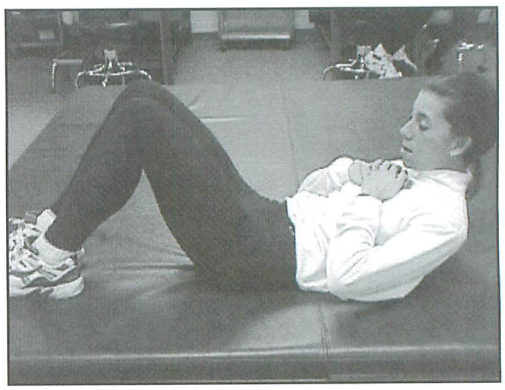


Figure 1. The curl up or crunch exercise. The head and shoulders are raised off the support surface. Knees are bent to encourage the patient to maintain the neutral spine position, avoiding a flexed spine position.

support as the opposing force to the anterior abdominal wall and are targeted during stabilization training. Single-leg extension holds, while on the hands and knees, produce mild extensor activity and low spine compression (Figure 3). The addition of the arms to the exercise increases the extensor activity but also the spinal compression. Prone lying extension (superman exercise) was found to exert very high compressive forces applied to a hyperextended spine, increasing the risk of injury and is not recommended for patients with low back pain.

The position of a 'neutral' spine is midway between maximal spinal flexion and maximal spinal extension. It often resembles the position of the spine in relaxed

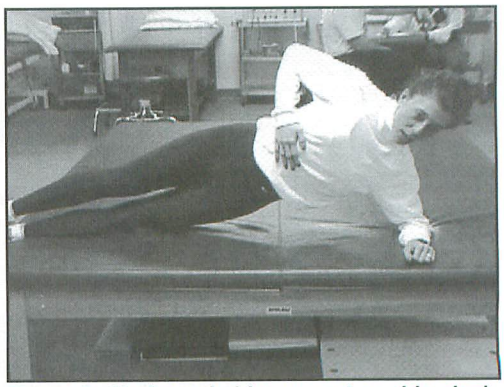


Figure 2. Horizontal side support or side plank. Supporting the lower body on the knees and a bent support arm, the patient elevates her torso toward the ceiling. To increase the difficulty, the patient may support her body with her feet rather than her knees when they are able to perform the exercise with ease.

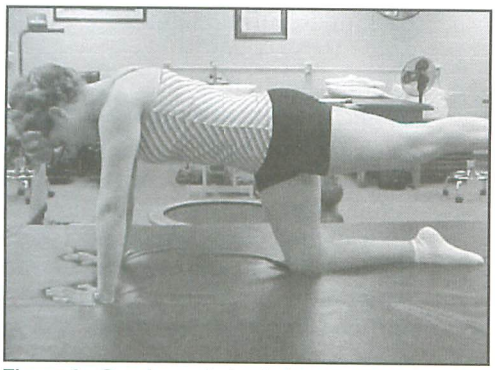


Figure 3. Quadruped single leg extension holds. The body is supported between the legs and arms and pelvic neutral is maintained while elevation of one leg is performed.

standing and is a comfortable position for the patient. Exercises performed in this position, rather than in a hypolordotic position such as a posterior pelvic tilt, allow for less stress on both the annulus and posterior spinal ligaments.[7] The neutral spine position coupled with lumbar stabilization exercises can provide the basis for successful rehabilitation programs.[8]

The use of electrical stimulation to improve muscular strength of the lumbar spine may be underutilized in the rehabilitation of patients with low back pain and injury. In cases where strengthening of the extensor musculature may be helpful such as extensor weakness, visible paraspinal atrophy, or segmental instability, electrical stimulation may be a useful adjunct to lumbar stabilization training. There is strong evidence to support the use of electrical stimulation for muscle strengthening.[9,10] In a study by Snyder-Mackler et al, a group of patients following ACL reconstruction who received electrical stimulation to the quadriceps plus exercise had greater strength gains than the group who received exercise alone.[10] This study indicates that volitional exercise alone may not be sufficient for restoration of the quadriceps following surgery. Sufficient dosage of electrical stimulation was based on the isometric force generated by the electrical contraction. The electrically elicited contractions demonstrated improvements in strength if the electrically elicited contraction was able to generate 50% of the force recorded during a maximal volitional contraction of the involved muscle. One advantage of the use of electrical stimulation for the lumbar paraspinal musculature of patients with low back pain is that it may allow for strengthening at levels less than 100% of the maximal volitional contraction, permitting strength gains and avoiding excessive spinal stresses and pain. Determining the necessary dosage of electrical stimulation to strengthen paraspinal musculature may be difficult since isometric force output of the lumbar extensors cannot be measured accurately without sophisticated measuring devices.

Electrical stimulation has been used for the lumbar paraspinal musculature in our clinic for the past 10 years. The electrical stimulation is provided isometrically to the lumbar spine. The patient is placed prone over pillows and their pelvis is strapped to the table in a posterior pelvic tilt position preventing the anterior tilt that would occur with spinal extension (Figure 4). To check position, the patient is asked to anteriorly tilt his or her pelvis to be sure little to no movement occurs at the lumbar spine. If movement occurs, the strap is tightened until no observable motion occurs. Two channels of electrical stimulation are simultaneously applied in parallel to the low back; one single channel on the right side and the other on the left (Figure 5). The current applied is a 2500Hz sine wave at 50 burst/second with a 2-second-ramp time for 12 seconds on and 50 seconds off for each contraction. Each treatment session consists of 10 to 15 contractions depending on patient tolerance. The therapeutic dosage is difficult to measure since it is difficult to clinically record maximal volitional contractions of the paraspinals in this position. We increase the current amplitude to reach the maximal tolerable contraction by the patient. At a minimum we look for a visible paraspinal contraction and in some extreme cases, the upper body may begin to rise off the table, indicating a strong contraction.

The following case will demonstrate the combined use of electrical stimulation and lumbar stabilization training with a figure skater following lumbar

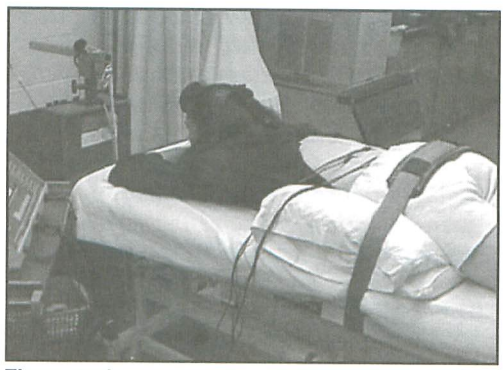


Figure 4. Isometric stabilization of the pelvis for electrical stimulation of the lumbar spine. The patient is positioned prone over pillows and the pelvis is strapped to the table in a posterior pelvic tilt. No movement should occur when the patient actively tries to tilt the pelvis anteriorly.

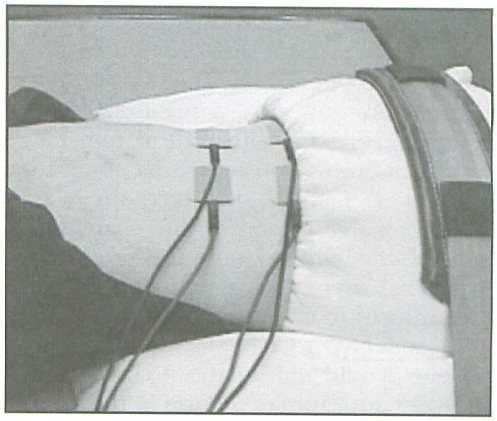


Figure 5. Electrical stimulation of the lumbar paraspinal musculature for strengthening. One channel is applied to the right side of the spine and a second is applied to the left. The intensity is increased to provide a visible contraction of the paraspinal musculature.

fusion. The patient was a 21-year-old figure skater who had an L5-S1 fusion with a titanium cage 1 year earlier. Five months before her physical therapy evaluation she had a second surgery for hardware removal. She had a previous course of therapy that she described as stabilization exercises, physioball exercises, abdominal exercises, acupuncture, and massage. She complained of a constant low back pain that since her second surgery increases with activity. She had been trying to return to skating for the last 2 months but was limited by pain and a sharp 'electric shock' pain from her back into her left buttocks when she landed on the ice and by the end of each day. She complained of a constant ache in her low back across the L5 region limiting her ability to attend college classes. Her pain would also increase with standing greater than 30 minutes and lying in the prone position. Her pain level was rated at an average of 4/10 with 0=no pain and 10=her worst imaginable pain. Her disability rating was a 20% on the Oswestry Rating Scale.[11] This scale measures the limitations in 10 areas of daily living as a result of her low back condition. The higher the score, the greater the disability. In her case, the disability rating was considered mild.

Range of motion testing revealed generally good range of motion in all directions compared to an uninjured woman her age; however, she was lacking the lumbar extension and sidebending needed to achieve certain positions in ice skating. She had central low back pain at the L5 region with lumbar extension and right sidebending and pain to the left buttock during lumbar extension and left sidebending. She also had re-creation of her pain during the return from full

forward flexion back to the upright position. This pain was alleviated when the therapist applied axial traction during return from this flexed position. The complaint of pain with return from forward bending is considered by some to indicate segmental instability; the segment is unable to control the change in motion while under stress. It is proposed that the creep of the lax ligaments allows the segment to achieve a position that is not conducive to reverse motion. The traction would unload the segment and allow for appropriate motion in the area, decreasing the patient's complaints.

Joint mobility testing revealed joint hypomobility at L4/L5 and motion here recreated pain that radiated to the left buttocks. Left unilateral joint posterior/anterior glides also recreated the pain to the left buttock and right unilateral assessments were painful locally only. The therapist determined that the hypomobility of L4/5 resulted in constant low back pain during the day and the area became overworked with activity. The overuse caused the referred symptoms to the buttock in the evening and during periods of extreme extension such as landing a jump on the ice. The patient was treated with joint mobilizations at L4/L5 and placed on a stabilization program emphasizing pelvic neutral to assist with the overall lack of stability seen with the forward bending test. The stabilization program consisted of learning to hold pelvic neutral and progressing with the following exercises: quadruped leg raises, side planks and maintaining pelvic neutral with hip motions into flexion, abduction, adduction and extension mimicking skating positions.

After 6 treatments, the patient demonstrated improvement in her ability to return to the upright position from forward flexion immediately following treatment but her difficulty returned the next day. Her pain levels were now intermittent rather than constant but she had difficulty correctly performing the stabilization exercises. During the exercise program, the therapist observed both rapid fatigue and muscle substitutions. Although the patient was demonstrating positive gains, they were slow and correct performance of the exercises was difficult. At that point we considered the addition of electrical stimulation to the lumbar paraspinal musculature to assist with strengthening in conjunction with her current program.

We were concerned with any contraindications for electrical stimulation in the area of her titanium cage and consulted the Material and Composites Department at the University of Delaware. They assured us that titanium would not conduct electricity and would not heat as a result of the intervention. The physician agreed with the plan to attempt the electrical stimulation treatments. After 15 treatments of electrical stimulation the patient's Oswestry disability score decreased to 12%. She had no pain with activities of daily living and was able to workout in the gym 1hr/4times weekly and could run 2 miles pain-free.

Once her activity level had increased and her pain levels improved, she began a skating progression for return to skating. She began being able to skate for 40 minutes without any shooting pain in her buttocks. Within 2 weeks, she was able to progress to stopping turns with only localized back pain. Four weeks later she could return to compulsories and only had low back pain with extreme twisting. She returned home for the summer and progressed to a Pilates based strengthening program and continued her skating progression. Nine months later she was skating 2 to 3 times/week with no complaints of low back pain or left buttock pain.

Electrical stimulation may show promise in assisting patients in recovering following lumbar injury especially when the person is returning to demanding activities. The stimulation may be beneficial for patients who are unable to perform other exercise programs due to pain or weakness. Although research clearly is needed to determine the effectiveness of the addition of electrical stimulation to a rehabilitation program for low back pain, no negative effects were seen with the addition of electrical stimulation in the presence of a titanium fusion. Therapists would also benefit from biomechanical evaluations of the electrical stimulation technique in order to provide information about the forces transmitted to the lumbar spine during this treatment. In our clinic, electrical stimulation is often added to the treatment programs of figure skaters with low back injury in an attempt to help prepare them for return to their high level activities and minimize time off the ice.

REFERENCES

1. Biemborn D, Morrissey M. A review of the literature related to trunk muscle performance. *Spine.* 1988; 13:655.
2. Cady LD, Bischoff DP, O'Connell ER. Strength and fitness and subsequent back injures in firefighters. *J Occup Med.* 1979;21:269.
3. Chaffin DB. Human strength capability and low back pain. *J Occup Med.* 1974;16:248-253.
4. McNeil T, Warwick D, Andersson G, Schultz A. Trunk strengths in attempted flexion, extension, and lateral bending in healthy subjects and patients with low-back disorders. *Spine.* 1980;5:529-538.
5. Fritz J, Hicks G, Mishock J. The role of muscle strength in low back pain. *Orthop Phys Ther Clinic North Am.* 2000;9:4, 529-547.
6. Callaghan JP, Gunning JL, McGill S. The relationship between lumbar spine load and muscle activity during extensor exercises. *Phys Ther.* 1998;78(1):8-18.
7. McGill S. Low back exercises: Evidence for improving exercise regimens. *Phys Ther.* 1998;78(7):754-765.
8. Saal JA, Saal JS. Nonoperative treatment of herniated lumbar intervertebral disc with radiculopathy: An outcome study. *Spine.* 1989;14:431-437.
9. Snyder-Mackler L, Ladin Z, Schepsis AA, Young JC. Electrical stimulation of the thigh muscles after reconstruction of the anterior cruciate ligament. *J Bone Joint Surg.* 1991;73-A:1025-1036.
10. Snyder-Mackler L, Delitto A, Bailey SL, Stralka SW. Strength of the quadriceps femoris muscle and functional recovery after reconstruction of the anterior cruciate ligament:A prospective, randomized clinical trial of electrical stimulation. *J Bone Joint Surg.* 1995;77-A:1166-1173.
11. Fairbank J, Davies J, Couper J, et al. The Oswestry low back pain disability questionnaire *Physiotherapy.* 1980;66(8):271-273.

Tara Jo Manal, PT, OCS is Clinic Director at the University of Delaware Physical Therapy Department in Newark, DE. Tara can be reached via email at tarajo@udel.edu

Hitz NL, ed. *Orthopedic Patient Education Resource Manual.* 2001, Aspen Pub-lishers, Fredrick, MD: Aspen Publishers; 2001, illus.

The objective of this manual is to provide the health care practitioner with prepared materials for patient education. The handouts are produced for educating patients who read at a 6th grade level or below so that most will comprehend them. As the editor, Nancy Hitz, writes, "Education is a cornerstone in assisting patients with musculoskeletal disorders." Educated patients have the information they need to (1) be compliant with parts of their treatment (they are not simply following your instructions blindly), (2) make informed decisions about their treatment, and (3) be potentially happier with their outcome because their expectations were clear and realistic. Especially in today's health care environment when we have less and less time to spend with patients, educating them is vital and having cost-effective and efficient ways of educating them is more important than ever.

The *Manual* contains handouts in English and Spanish. An accompanying diskette contains the handouts as Word documents, allowing a clinician to edit the handouts for specific patients or physician's instructions.

The *Manual* consists of 6 patient education sections, an Appendix that contains a comprehensive list of resources for practitioners and patients, and an index.

The first section entitled, Effective Patient Education, is a great introduction to this work. This section hopes to teach health care professionals how to be better educators, or perhaps to start thinking of themselves as educators in the first place. The section also contains practical information regarding writing and making easy-to-read materials for patients. As the editor writes, "writing for peer-reviewed journals or other professional vehicles is very different than writing for the general public."

The second section contains materials about diagnostic tests. Arthroscopy is included in this section because of its diagnostic element. Four diagrams of the knee are included. One picture titled 'Lateral View of the Knee' is slightly out-of-focus and actually appears to be more of an anterior-medial view of the knee because you can barely see the fibula. The figures are correctly labeled with anatomical terms. Lay terms for anatomy (ie, knee cap) might be nice to add for patients with reading levels of 6th grade and below.

Sections 3 and 4 cover traumatic and nontraumatic orthopaedic diagnoses like fractures, sprains, tendonitis, arthritis, ACL injuries, and low back pain. Many handouts such as the one covering wrist sprains mention using ice and heat during recovery. Most suggested using heat after 3 days. I suppose that if that is not appropriate the clinician would change the handout, but I feel a little uncomfortable with such a generalization. If the person has done anything to exacerbate the inflammation, after any number of days, heat may not be a good treatment choice.

Figures of appropriate anatomy can be found after each diagnosis. Again, lay terms would be appropriate. Some of the handouts for shoulder problems and arthritis found in sections 3 and 4 are not marked as other handouts. Although very well done, I wondered as I read them why they were not written for a specific grade level. These particular handouts are also not contained on the disk, perhaps because they are taken from outside sources like the US Department of Health and Human Services. Many handouts like 'Preventing Carpal Tunnel Syndrome' describe specific exercises either for recovery or prevention. The exercises are described in words where a picture or two would be much more effective in educating the patient and the handout would also be more interesting to read.

The fifth section, Pain Management, is the most valuable section of the manual, since education is vital to the successful management of pain. The section is comprehensive, containing information about relaxation techniques, medications, arthritis pain, planning for pain control after surgery, and the procedures involved in epidural steroid injections. The latter handout contains space for questions to ask the doctor, which the handouts in general encourage patients to do.

In fact, section 6, titled 'Surgical Procedures and Techniques,' begins with a handout called *Questions To Ask Your Doctor Before You Have Surgery*. Many of the handouts regarding surgical procedures are related to other orthopedic conditions that are discussed in sections 3 and 4. In these cases, the handout does a good job of summarizing the conservative treatments that may be tried before surgery. The index is useful for finding materials that may cover a condition in other sections. The index on the diskette is not as organized as the printed index.

A few handouts in the surgery section use the word *will* where I think the word *may* is more appropriate. For example, in the handout called 'Total Knee Replacement' the material states "three days after surgery until discharge-you will walk using 2 crutches." The patient expects then, that after surgery, he will be walking with 2 crutches. When the patient is walking with a walker instead, the expectation has failed. What is the impact of that? Maybe it is nothing, but maybe it decreases their motivation because they don't think they are doing as well as they should. In addition, the same handout states that by the time of discharge home, "You *will* be able to go up and down stairs." Is this a realistic goal? Making this a concrete expectation by using *will* may even misguide the patient by giving them a false expectation. Saying instead that, "You *may* be able to go up and down stairs" lowers the expectation. If the patient does, he can celebrate his accomplishment. These instances are rare, but they do remain; and I think have the potential to cause serious problems with patient satisfaction.

The materials in general are very positive and empowering in their language in addition to setting realistic expectations. With some editing where necessary, the tools in the manual can return great dividends to a practice by helping health care providers with the important task of educating every patient.

Allyson Baughman, MPT

Harrelson G, Leaver-Dunn D. *Joint Mobilization - Techniques for Managing Restricted Range of Motion.* Thorofare, NJ: Slack, Inc.; 2002, CD ROM (for Microsoft Windows or Apple Macintosh systems).

This CD-ROM is designed to teach the basic principles of joint mobilization. The

authors have incorporated the use of audio, text, photos, animation, and video to assist with instruction. Full explanations are provided in audio form throughout and are supplemented with text. The CD-ROM is organized into 3 major components that are clearly structured and easily navigated.

The first category, 'Principles of Joint Mobilization,' begins with an overview to introduce the learner to the goals of the CD-ROM, a description of joint mobilization, and its clinical uses. Principles of joint mobilization are further addressed in 6 sections including Joint Kinematics, Physiologic Effects, Joint Assessment, Concave-Convex Principle, Indications-Contraindications, and Application of Joint Mobilization. These sections include photos and animation to demonstrate concepts and techniques. Practice questions are available at the end of each section for learners to assess their knowledge of the material.

The second category, 'Body Regions,' includes detailed instructions on joint mobilization techniques for 10 regions of the body (foot, ankle, knee, hip and pelvis, sacroiliac joint, spine, shoulder, elbow, wrist and hand). Audio instruction guides the learner through each technique, while a videotaped clinician demonstrates hand placement and application of force. Some video segments are supplemented with animated bone models to enhance visualization of the arthrokinematic movements taking place during the mobilizations.

The third category consists of a bank of multiple choice questions designed to assess the learner's knowledge of principles and application of joint mobilization. The questions represent information covered in the CD-ROM and include patient scenarios that require the learner to make decisions regarding the necessity, type, and application of joint mobilization techniques. Immediate feedback is given after each question, and a tally of correct answers is provided upon completion of the quiz.

This CD-ROM provides a very nice introduction to the purpose and practice of joint mobilization. Educators may find this product useful as an instructional tool. Students will benefit from the straightforward explanations and clear visual demonstrations provided. Easy access to the information, thorough explanation of the mobilization techniques, and the immediate feedback provided by self-assessment makes this an excellent teaching instrument.

Brenda Boucher, PT, CHT, PhD

Bohndorf K, Imhof H, Pope TL. *Musculoskeletal Imaging: A Concise Multimodality Approach.* New York, NY: Thieme; 2001: 387 pp., illus.

The authors of this textbook offer a new approach to learning diagnostic imaging of bones and joints. There are a number of features in this book that the authors' feel will enhance the reader's ability to learn. The information is presented in 2-page spreads, with text on the left page and corresponding images on the right. There are over 1,000 radiologic images and 300 schematic drawings to allow for easy visualizations of findings. Furthermore, the core essentials of radiology are continually emphasized in various illustrations and problem solving situations throughout the book in order to ensure the reader has a grasp of the basics of radiologic imaging and its implications clinically.

Radiologists, orthopedic surgeons, and physicians who specialize in rheumatology, trauma, internal medicine, and nuclear medicine author this textbook. The collaborators have given the viewer the ability to visualize and comprehend what these experts believe is essential to understanding diagnostic testing in a given field.

This textbook focuses on trauma and arthrology, which appears to be the foundation for all radiologic textbooks. However, this text also discusses topics such as: infection, tumors, hematologic disorders, and bone and soft tissue disorders. The main focus is an understanding of radiologic tests for the above-mentioned disorders; however, the textbook also supplements the radiologic material with MRI, CT, nuclear medicine, and ultrasound reports and pictures to allow the reader to appreciate the entire scope of testing that a patient may undergo to diagnose a particular problem. This also allows the reader to understand how different diagnostic tests can enhance a clinicians understanding of a particular disorder/disease.

Although most applicable to the radiologist, this book would also be a valuable reference for any health care professional. The information offered is concise and easily referenced which will make this textbook attractive to the health care professional that routinely deals with musculoskeletal imaging.

Susan Mercik Davis, PT, MS

Schleck LA. *Staying Strong—a Senior's Guide to a More Active and Independent Life.* Minneapolis, Minn: Fairview Press; 2000:249 pp, illus.

As a guide, *Staying Strong* lives up to the task. Aimed at an older population with challenges varying from improving a golf game to getting out of bed, the authors, with consistent editing by Ms. Schleck, identify activities needed to preserve critical life skills. The text avoids *preaching* but instead develops simple rationale for regaining and maintaining strength during the later decades of life. Research is cited, but reference lists are absent should one wish to follow up for more in-depth detail.

A sprinkling of examples serves as proof that the recommended regimens will produce results. Goal setting is modest. The often-ignored detail of what to do when progress has reached a plateau is addressed. Clear photographs accompany the directions for each exercise. Absent is the detail therapists obsess over in giving exercise prescriptions—perhaps too absent, as correct posture and correct starting positions are not part of the instruction. Progressions are suggested for repetitions and resistance. Resistive bands are the only nonhousehold equipment needed—except for a good pair of walking shoes.

The authors present exercise programs in 7 categories: general strengthening, osteoporosis prevention and strengthening, balance (including falling prevention), strength training for golfers, training in a pool, in a chair, and in bed. Flexibility is included as the 'warm-down' component of each of the strengthening programs.

The book contains important information for the majority of older people. It deserves a place among recommended home programs following therapy interventions. It would make a useful gift to our sedentary or older friends and relatives.

Jill Floberg, PT

Chipchase L, Brumby SA. *In-patient Physiotherapy: Management of Orthopaedic Surgery.* Boston, Mass: Butterworth-Heinemann; 2001:157 pp, illus.

As noted in the preface, this book has been written as an introduction to clinical physical therapy procedures for inpatients who have undergone ortho-

paedic surgery. The primary intention of the book is to provide physical therapist students with sufficient information before clinical placement to an in-patient orthopaedic setting. The authors of the book are a physical therapist and an orthopaedic surgeon.

The book is comprised of 9 chapters. The first 5 chapters outline basic principles that apply to the care of in-patients who have undergone orthopaedic surgery. Chapter 1 describes the basic science of bone and soft tissue healing, common orthopaedic disease processes, and classification and basic surgical management of major musculoskeletal trauma. Chapter 2 outlines routine medical tests, equipment, and medications that physical therapists may encounter when working with in-patients in an orthopaedic setting. Chapter 3 describes general principles of in-patient physical therapy assessment and management. Chapters 4 and 5 cover the skills necessary for effective gait and mobility education, and for transferring and lifting patients.

The last 4 chapters cover postoperative management of hip, knee, shoulder, and foot and ankle surgeries. The management of more common surgical procedures is described. For example, with regard to the knee, the following surgical procedures are covered in some detail: total knee replacement, knee arthroscopies (ie, chondroplasty, osteoplasty, lateral release, meniscectomy, meniscal repair), and anterior cruciate ligament reconstruction. The postoperative management of surgical repair for fractures is also covered quite extensively.

As pointed out by the authors, some of the surgical procedures covered in the last 4 chapters of this book may be performed in day surgery units (ie, patients discharged on the same day of the surgery) and therefore, may not require extensive in-patient management. Nonetheless, surgical descriptions, hospital requirements, radiological techniques, postoperative management, and possible complications are adequately described for the procedures covered in this book. Included in the postoperative management are physical therapy treatment guidelines, which in some cases cover the first 4 to 6 weeks following surgery. The physical therapy treatment guidelines include the more commonly prescribed exercises, which are nicely described at the end of each chapter through high quality photographs that support the text. As noted by the authors, the inclusion of common exercises and protocols is not meant to replace the need for clinical reasoning and problem solving, but rather provide a sound base from which students can further develop and learn.

This book fills the gap between orthopaedic surgery texts and those concerned with outpatient orthopaedic physical therapy. Although not the purpose of this current edition, future editions of this book should consider including the postoperative management of spinal surgeries. Because of its practical, step-by-step approach for the physical therapy management of the more common orthopaedic surgical procedures, this book would serve as an excellent reference for physical therapist students and physical therapists that have limited experience working in an in-patient orthopaedic setting.

Michael Ross, PT, DHS, OCS

Isaacs ER, Bookhout MR. *Bourdillon's Spinal Manipulation. 6th Ed.* Boston, Mass: Butterworth-Heinemann; 2002: 320 pp, illus.

The sixth edition of Bourdillon's Spinal Manipulation is a welcomed update of the classic manual therapy text. The previous edition was printed in 1992 and was past due for the incorporation of more current literature. The book introduces the reader to a thorough but concise history of spinal manipulation a.k.a. *bonesetting*, tying together the osteopathic, chiropractic, and physical therapy professions. The contents of the text are divided into 15 chapters, including the introduction, anatomy and biomechanics, whole spine and pelvis examination, manipulation, treatment strategies, pain patterns, muscle imbalances, and exercises.

The first chapter is the introduction, which provides the reader with a background of John Bourdillon and a history of manual therapy. Chapter 2 reviews the anatomy and biomechanics of the spine and pelvis. The review is appropriate for the established manual therapist. It includes descriptive charts and figures to assist in the biomechanical explanations.

The third chapter covers the general considerations and contains discussion of terminology and nomenclature related to examination. It includes somatic dysfunction, palpation, visible assessment, overall screening process (standing, sitting, supine, and prone), and radiographic analysis. It would have been beneficial for the authors to incorporate more functional analysis as it relates to screening and treatment.

The fourth and fifth chapters introduce the reader to the detailed exam of the pelvis and whole spine respectively. The detailed exam of the pelvis reviews functional anatomy and biomechanics, palpation landmarks and motion testing, motion characteristics of the SIJ and the relationship to the walking cycle, the sequence of a detailed exam, and diagnosis of the pelvic dysfunction. The pelvic girdle complex is a challenging region of the body to evaluate and treat, even for the experienced clinician. This chapter would be difficult to follow for anyone other than the established manual therapist. The detailed exam of the spine, covered in chapter 5, discusses terminology, spinal motion characteristics, types of dysfunction, and positional diagnostic techniques. The authors could have updated some of the photos in these chapters to more clearly exhibit the examination techniques.

Chapter 6 reviews manipulation and the variety of techniques established. The chapter includes the types of manipulation, soft tissue techniques, effects of manipulative techniques on the CNS and muscle tone, localization of force, and subsequent visits. This chapter provides the reader with an unbiased view of the many techniques available to the clinician. However, the authors neglected to include neural mobilization as one of the manual therapy approaches used more readily this past decade.

The seventh through eleventh chapters cover the treatment of the pelvis, lumbar spine, thoracic spine, rib cage, and the cervical spine. These chapters incorporate all of the techniques with detailed descriptions of patient and clinician positioning and manual procedure focusing on thrust and muscle energy techniques. The chapters also include insert boxes called diagnostic points, which help guide the reader as to what to look for with each dysfunction. The pelvic chapter contains the pubis, innominate and iliac shears, SI dysfunctions, and iliosacral dysfunctions. The lumbar chapter focuses on side-lying, side-bending, and rotatory techniques, and sitting techniques. The thoracic chapter instructs in sitting, supine, and prone techniques. The rib cage chapter discusses description and diagnosis, respiratory and structural ribs, and treatment of respiratory and structural rib dysfunctions. Chapter 11 covers the cervical spine and describes the typical cervical vertebrae (C2-C7), AA joint (C1-C2), and OA joint (CO-C1) and treatment strategies for the aforementioned.

These chapters include numerous manual therapy techniques and can be overwhelming with their biomechanical detail. The pictures of the techniques are adequate although some are difficult to see clearly. The anatomical figures that were used in addition to some pictures were helpful in the readers' understanding of the techniques.

Chapter 12 discusses the lumbosacral junction and provides an overview of treatment strategies for the spine. The chapter includes the diagnosis and treatment of dysfunctions at the lumbosacral junction; recommended order of treatment for the pelvis and lumbar spine; recommended order of treatment for the thoracic and cervical spine; patients with special problems including scoliosis, postoperative issues, spondylosis, HNP, hypermobility, and leg length discrepancy; and frequency/duration of treatment. This chapter nicely ties together the variety of spinal conditions seen at the clinic level.

The thirteenth chapter addresses pain patterns and musculoskeletal dysfunction. The topics are principles for the differential diagnosis of *back pain*, dealing with the patient's pain, application of manipulative techniques, and pain reduction. This chapter includes computer-generated figures that are helpful for the reader to follow pain referral patterns.

Chapter 14 covers the examination and treatment of muscle imbalances of the upper and lower quarter. The treatment techniques include mobilization, stretching, and retraining. The chapter provides good photo images of the stretches and muscle re-education exercises discussed. It details the muscles most likely to require stretching vs. retraining.

The final chapter reviews the appropriate exercises as a complement to manual therapy. The lumbar, pelvic, thoracic, and cervical spinal regions are included. Although this text is a manual therapy book and this chapter is not intended to be extensive, the authors could have expanded this chapter to be more up-to-date with segmental and whole spinal stabilization techniques and exercises. The chapter primarily focuses on stretching and self-mobilization techniques.

The sixth edition of this classic textbook is recommended for the established and advanced manual therapist. It would not be recommended for the entry-level clinician or the beginning manual therapist. The techniques covered are mostly high velocity and muscle energy, which require extensive training. The authors could have included more up-to-date references in a few of the chapters. In addition, the authors could have restored some of the photos that are not very clear. The reader needs to have a strong biomechanical knowledge base before using this book.

Cory Tovin, PT

Boots, Blades, & Skaters *(continued from page 29)*

2. Mason J. Figure Skating Science at the 21st Century. American College of Sports Medicine Symposium; 2001.
3. Yu L. Figure Skating Science at the 21st Century. American College of Sports Medicine Symposium; 2001.
4. Richards J. *Biomechanics of Landing Jumps*. Lake Placid, NY: 2000 Team USA Training Camp; 2000.

ACKNOWLEDGEMENT

The author would like to thank Jennifer Mason, PhD, Bob Dunlop, Judy Holmes, PT, Amy McDowell, PT, Katie Stephens, PT, Mary Kroth-Brunet, PT, Leisure Yu, MD, Mahlon Bradley, MD, Stephanie Giannetti, and Olympic skaters Karen Courtland-Kelly and Patrick Kelly for their assistance in the development of this article.

Linda Tremain, PT, ATC is currently working at Personal Best Performance in Westmont, Illinois. Linda can be reached via email at ltremain@ msn.com.

OCCUPATIONAL HEALTH
PHYSICAL THERAPISTS
SPECIAL INTEREST GROUP

ORTHOPAEDIC SECTION, APTA, INC.

Summer 2002 Volume 14, Number 2

USING ELEMENTS OF THE WASHINGTON ERGONOMIC RULE IN YOUR PRACTICE

Janet Peterson, PT, Ergonomic Consultant

Washington State has an ergonomic rule as of May 2000 that applies to all employers in the state (except federal employees). It is substantially different from the repealed OSHA law: it is preventive in orientation, and it does not include medical management. There are elements of this rule, even though it is for Washington State, that you may want to incorporate into your own occupational health programs with your injured workers and in your ergonomic work. Because the principles in the rule are based on sound research, it has a high degree of credibility in the field of ergonomics. Here are some examples of how you could use it:

1. **Caution Zone Checklist**

If you are looking for an easy screening tool with which to evaluate risks for Work-Related MusculoSkeletal Disorders (WMSDs), the Caution Zone Checklist may be of help. This checklist is available to download from the Washington web site: http://www.Ini.wa.gov/wisha/ergo in a user-friendly, 2-page format with drawings and check boxes. It identifies 14 risks such as awkward postures, (example: working with the hands above the head or the elbows above the shoulders for more than 2 hours total per day), high hand force, highly repetitive motion, repeated impact, lifting, or arm vibration. You could use this as a quick screening tool to weed out the higher-risk jobs in a big company, or as a train-the-trainer tool to help managers identify stressful working positions for their employees.

2. **Hazard Zone Checklist**

This is a more detailed checklist (21 items instead of 14) and includes a higher exposure to WMSD stresses (Example: working with the hands above the head or the elbows above the shoulders for more than 4 hours total per day). In Washington State, a job that reaches this Hazard Zone level of exposure must be changed by the employer to reduce the risks to the workers. You could use this checklist to help justify a recommendation for a hazard reduction to a company, or to emphasize the seriousness of an awkward work posture.

3. **Lifting Calculator**

Although the Lifting Calculator is part of the Hazard Zone Checklist, it can also be used as a stand-alone method for evaluating lifting risks. A simplified version of the NIOSH lifting equation, this lifting calculator is fast to use yet still gives specific information on what the limiting factors are (start position, frequency of lift, twisting, etc.). Plus, the web site (http://www.Ini.wa.gov/wisha/ergo) has a calculator program built in that does the math for you! Just plug in the numbers and not only do you get a "yes, OK" or "no, Hazard," but you also find a pop-up screen with suggestions on how you might change the task to reduce the lifting hazards. For those of you who find the NIOSH lifting equation cumbersome but are still wanting to include some objective measure of risk, this calculator could be helpful. Also, it is something that could be taught to a safety committee or ergo team within a company.

4. **Ergonomic Awareness Training**

There are a couple of training programs available online that you may want to adapt or copy for your own training programs. One is a presentation on the elements of the rule. The only parts of this that might be helpful are some statistics about injury and risk, and cost-effectiveness of ergonomics programs that you could use to help justify a proposal for a client. Another one is a basic training program on ergonomics, aimed at workers. While you would not want to use the whole program outside of Washington State, there are parts of the program that are more generic (defining ergonomics, describing WMSD symptoms, showing awkward postures, etc.) Both of these slide programs are downloadable, in PDF format that you can then alter for your own use. On the Washington ergo web site (http://www.Ini.wa.gov/wisha/ergo), click on "ergonomics rule slide presentations," then click either on "Ergonomic Awareness Education" or "The Washington Ergonomic Rule." There are some nice pictures of actual workers in the slide shows that might be helpful for you. I have successfully used some of these slides in my own practice, personalizing them for use with a specific client.

REQUEST FOR ORTHOPAEDIC SECTION MEMBERS TO SUBMIT POSTER/PLATFORM PRESENTATIONS FOR CSM 2003

Orthopaedic Section/Occupational Health SIG members please consider doing an Occupational Health related poster/platform presentation next year at CSM. We want to hear what clinically relevant interventions and research you are performing to enhance all our working knowledge in the field of Occupational Health. We need to let the public know that PTs are an integral part of a comprehensive Occupational Health prevention and treatment programs.

Contact OHSIG Board members for ideas on topics and watch for future announcements in *OPTP* for submission requirements.

ON-SITE PHYSICAL THERAPY/ERGONOMICS PROGRAM CITED AS PART OF COMPANY BENEFITS & CULTURE IN "2001 BEST LARGE COMPANY TO WORK FOR IN NEW HAMPSHIRE"

Company also made #12 in Fortune Magazine's Nationwide Search for "100 Best Companies to Work For"

Hypertherm, Inc., the world's leading manufacturer and distributor of plasma arc cutting equipment, was recently awarded "Best Company to Work For in New Hampshire" – Large Company Division, for the second time. Bonnie Sussman, PT, MEd, (an OHSIG member and current Vice President) has been an on-site consultant for Occupational Health Services with Hypertherm since 1996, during which time the company has seen a significant improvement in its safety record, lost time injuries, and overall Workers' Compensation costs. In the December, 2001 article in BUSINESS NH Magazine, the description of the winning company included the following: "Hypertherm promotes wellness through annual health screenings, its volleyball and basketball courts, its one-kilometer outdoor Hypertherm Trail, and daily aerobics sessions in its exercise room…Assuring an ergonomically effective workplace, a registered [sic] physical therapist visits weekly to review and make recommendations."

Hypertherm went on to apply for and receive recognition in FORTUNE Magazine's "The 100 Best Companies to Work For,", coming in at a whopping 12th place. Although their on-site occupational health physical therapy program was not mentioned in the Fortune Magazine publicity, it was described and included as part of the application process.

Hypertherm's Occupational Health Program includes weekly on-site visits by Ms. Sussman, who is employed by Cioffredi & Associates Physical Therapy, a group private practice in Lebanon, NH. As part of the program, Ms. Sussman screens employees with early physical complaints, monitors employees with more serious injuries (including case management), and develops and monitors transitional return-to-work plans. She works closely with Engineering Teams in design and modification of both industrial and office ergonomics, and is a standing member of the company's Safety Committee. Employees may receive limited care on-site, or additional physical therapy services as needed in the Cioffredi & Associates clinic.

CALL FOR NOMINATIONS

This Fall, the Occupational Health Physical Therapy Special Interest Group will be electing three officers—President, Treasurer, and one member of the Nominating Committee.

The terms are for three (3) years, commencing February 2003. The President and Treasurer serve as a voting member of the OHPTSIG Board of Directors. The member of the Nominating Committee elected this year will be Chairperson of the Nominating Committee during the third year of his/her term (2005-2006).

Nominations for these positions are now being solicited. Self-nominations are acceptable. The Nominating Committee will contact individuals suggested to verify interest, and to obtain any necessary information on personal background. Those making nominations need to supply a full name, address, telephone number, and e-mail address if possible for a potential nominee. The Nominating Committee will take care of the rest of the work.

Nominations should be submitted by mail or e-mail to:

Allen Wicken
OHPTSIG, Nominating Committee
PO Box 838
Gull Pond Rd
Rangeley, ME 704970
allenwicken@yahoo.com

The deadline for submissions of names to the Nominating Committee is *August 16, 2002*. The final slate of candidates will be available *September 3, 2002*.

OHSIG Officer Listing

PRESIDENT
Deborah Lechner, PT, MS
ErgoScience, Inc
15 Office Park Circle, Ste 214
Birmingham, AL 35223
Ph: 205 879-6447, ext. 204
Fx: 205 879-6397
Email: deborahlechner@ergoscience.com

VICE PRESIDENT
Bonnie Sussman, PT, MEd
Cioffredi & Associates Physical Therapy
PO Box 727
Lebanon, NH 03766
Ph: 603 643-7788
Fx: 603 643-0022
Email: bsussman@tpk.net

TREASURER
Mark Blankespoor, PT
1316 N Prairie St
Pella, IA 50219-1383
Ph: 641 621-0230
Fx: 641 621-0319
Email: worksystems@lisco.com

SECRETARY
Karen J. Elton, PT, MA
Therapeutic Associates of Central Oregon
2600 NE Neff Road, Ste B
Bend, OR 97701
Ph: 541-388-7738
Fx: 541-388-7785
Email: kelton@taiweb.com

PRACTICE & REIMBURSEMENT
Kenneth J. Harwood, PhD, PT, CIE
Columbia University
710 West 168th St, 8th Fl
New York, NY 10032
Ph: 212 305-1649
Fx: 212 305-4569
Email: kh111@columbia.edu

RESEARCH
Frank Fearon, PT, DHSc, OCS, FAAOMPT
North Georgia College & State University
Barnes Hall-Department of Physical Therapy
Dahlonega, GA 30597
Ph: 706 864-1899
Fx: 706 864-1493
Email: ffearon@ngcsu.edu

EDUCATION
Deirdre Daley, PT, MSHOE
ProActive WERC Center
1211 Ireland Drive, Ste 11
Fayetteville, NC 28304
Ph: 910 678-8085
Fx: 910 678-8683
Email: kanandarqu@aol.com

NOMINATING
Allen Wicken, PT, MS
Wellness Program Director
Rangeley Region Physical Rehabilitation & Wellness Pavillion
PO Box 722
Rangeley, ME 04970-0722
Ph: 207 864-3332
Fx: 207 864-9062
Email: allenwicken@yahoo.com

MEMBERSHIP
Scott Duesterhaus Minor, PT, PhD
Washington University School of Medicine
4444 Forest Park Blvd., Box 8502, Room 1101
St. Louis, MO 63108
Ph: 314 286-1432
Fax: 314 286-1410
Email: minors@msnotes.wustl.edu

FOOT & ANKLE

SPECIAL INTEREST GROUP
ORTHOPAEDIC SECTION, APTA, INC.

The Combined Sections Meeting in Boston was a success again for the Foot and Ankle Special Interest Group. Our 4 hours of programming was well attended with an overall audience of over 250. The FASIG would like to acknowledge Mark Cornwall, Vice Chair in charge of organizing the educational program. Mark will have another year of planning the program for Tampa in 2003.

Twenty-eight participants attended our Business Meeting. William Meredith was elected to the Nominating Committee, chaired by Byron Russell. Reports of each of the officers were presented and can be seen on the web site as well as the minutes of our Business Meeting.

Goals for the upcoming year are:

1. The SIG is trying to expand our members on the "Find a Foot and Ankle Physical Therapist" located in the Orthopaedic Section web site. Please take time to go through the Section web site and click on the Special Interest Groups. Take time to enter your information and become visible as a referral for other physical therapists and the public.
2. Planning the program for CSM 2003 in Tampa is starting now.
3. A preconference course at CSM 2003 is in the planning stages of development. The topic at the present time will be case presentations and the use of foot orthoses as part of the treatment. Included will be demonstration labs. Watch for more information in future issues of *OP*.

FOOT & ANKLE OFFICER LISTING

CHAIR:
Stephen F. Reischl, PT, DPT, OCS
2650 Elm Ave, Ste 214
Long Beach, CA 90806-1600
(562) 427-2225
(562) 427-5656 FAX
reischl@earthlink.net

VICE CHAIR:
Mark Cornwall, PT, PhD, CPed
Northern Arizona University
Dept of Physical Therapy
NAU Box 15105
Flagstaff, AZ 86011
(520) 523-1606
(520) 523-9289 FAX
mark.cornwall@nau.edu

SECRETARY/TREASURER:
Stephen G Paulseth, PT, MS
2040 Ave of the Stars Ste P104
Los Angeles, CA 90067-4708
(310) 286-0447
(310) 286-1224
paulsethpt@earthlink.net

NOMINATING CHAIR:
Byron Russell, PT
EWU Dept PT 353 PAU
526 5th Street
Cheney, WA 99004-2431
(509) 623-4306
(509) 623-4321 FAX
bryon.russell@mail.ewu.edu

PRACTICE CHAIR:
Joe Tomaro, PT, MS, ATC
490 East North Ave, Suite 501
Pittsburgh, PA 15212
(412) 321-2151
(412) 434-4909 FAX
tomaro@dug3.cc.edu

Performing Arts Special Interest Group • Orthopaedic Section, APTA

MESSAGE FROM THE PRESIDENT

Hello everyone! The PASIG has been quite busy since CSM and you have no further to look than this current issue of *Orthopaedic Physical Therapy Practice (OPTP)*. We were honored to have been asked by the editors of *OPTP* for our participation in this special issue devoted to PT and the Performing Arts. I think you'll agree that we've tried to pull together a well-rounded group of authors. Please join me in whole-heartedly thanking them for their hard work and for sharing their expertise! We could not have completed this issue without each of their efforts.

I'm sure that CSM 2003 seems a long time away, but we've already begun planning for the meeting, which happens in Tampa, Florida. The PASIG has begun development of a preconference course which will focus on dance medicine. We have a chance to share some of our expertise in this area and raise funds for the future direction of the PASIG. Lynn Medoff, our Vice President and Education Chair, can most certainly use your input, ideas, and help for both the preconference course and PASIG general programming. Contact Lynn with your suggestions.

On another front, and as a result of meetings at our recent CSM conference, the Special Interest Group (SIG) Presidents have formed a task force with representative members of the Orthopaedic Section Board to increase our communication between one another and with the Orthopaedic Section Board of Directors. Ultimately, we believe this improved communication will benefit our growth as a special interest area. Our practice analysis is slated to move along with the long-awaited survey just as soon as we can secure the services of the firm that will be compiling the survey data for us. Keep listening for more about the survey from your Regional Director. If you do not know whom your regional director is, contact Susan Guynes to get contact information. The PASIG may not have correct contact information for you.

We still need volunteers to serve on various committees to help move our special interest group along. There is always relatively little work to do if many people are willing to help. We can also still use volunteers to fill out the Regional Directors and improve our internal communication about PASIG issues/goings-on. You can contact Susan Guynes at the e-mail address listed below. If you have article ideas or a publication venue that would like us to submit a performing arts-related article, please contact Adrienne McAuley at the address listed below. She is actively seeking your ideas. Take a look below at the committees within YOUR special interest group. We encourage YOU to get involved!

Remember, we're only as strong as our members! I think this issue of *OPTP* will be well received and should give each of us confirmation that what we do is something special and worthwhile. Enjoy!

All the best,
Jeffrey T. Stenback, PT, OCS
President, Performing Arts Special Interest Group

AILEY 2 THANKS WESTERN STATES PTs

I would like to extend our gratitude and thanks to the PTs in Alaska, California, Idaho, Oregon, and Washington who contributed to the wellness of the dancers in Ailey 2 during their recent tour of the western United States. The dancers are grateful for your time and support. You helped to make this an injury-free and successful spring tour!

Sincerely,
Shaw Bronner PT, MHS, OCS
Director, Alvin Ailey Therapy Services

SEVERAL APTA PASIG MEMBERS TO PRESENT AT RENOWNED INTERNATIONAL DANCE MEDICINE CONFERENCE, NEW YORK CITY, OCTOBER 2002

This year marks the twelfth anniversary of the International Association for Dance Medicine and Science (IADMS). The IADMS is a multidisciplinary organization created to serve as a forum for education, promotion of research, and public service in the field of dance medicine and science.

In keeping with the APTA's Performing Arts Special Interest Group's commitment to providing physical therapists with the most current trends and practices in the performing arts, IADMS is excited to announce that several of the PASIG members will serve in key presentation modes dur-

ing this continuing education event for the dance and medical communities. The IADMS annual education is focused on issues such as efficient training for dance; correct physical conditioning to prevent illness and injury resulting from dance activity; psychological support for dancers; proper nutrition for the dancer; and appropriate treatment and rehabilitation for dance-related injuries. Communication and co-operation between dancers and those persons concerned with their physical and psychological welfare in the fields of medicine, science, and education is encouraged and developed.

In a little more than a decade, IADMS has created a peer-reviewed journal, *Journal of Dance Medicine and Science*, which serves to disseminate dance-specific clinical and experimental research and to provide reviews of current knowledge and practice. In addition, IADMS has been integral in the creation of two other unique dance references, the Dance Medicine and Science Bibliography and the Dance Medicine Resource Guide. The bibliography is the only one of its kind, containing over 2,000 English language scientific research articles in the fields of anatomy, physiology, sports medicine, physical therapy, somatics, body therapies, dance therapy, dance education, kinesiology, biomechanics, movement analysis, psychology, and nutrition. The Dance Medicine Resource Guide includes a comprehensive listing of dance-related literature, audio-visual resources, products, educational opportunities, and practitioners in fields such as medicine, physical therapy, chiropractic, athletic training, and somatics. Information on these publications can be found on the association's website at www.iadms.org.

This year the meeting will be held October 25 - 27, 2002, in the great city of New York, hosted by the Harkness Center for Dance Injuries at the Hospital for Joint Diseases. The venue for the conference will be the Farkus Auditorium and Alumni Hall of New York University's School of Medicine and Medical Center. The IADMS Annual Meeting features original papers, review lectures, workshops, forums, posters, and movement sessions covering various aspects of clinical dance medicine, dance medicine research, dance science, and dance education. A special focus of this year's conference is "hip problems in dancers."

Annually, the conference draws professionals from fields such as dance, dance education, medicine, psychology, nutrition, kinesiology, physical therapy, athletic training, Pilates, and somatics in addition to students of dance and science. The meeting provides a rare opportunity for allowing many diverse disciplines to come together to share knowledge and promote understanding of dance medicine and science, which are essential to the future of dance and dancers alike. The conference objectives are geared to providing an invaluable experience for persons interested in improving dancers' health, well-being, and performance.

As in recent years, IADMS will offer a special 1-day conference, "A Day for Teachers" proceeding the Annual Meeting, focusing on issues involving turn-out and alignment for educators and dancers. It will feature a lecture and demonstration by Irene Dowd. This is truly a unique educational event that no one in the dance community should miss.

Visit the IADMS website at www.iadms.org for more information about the organization and the conference. You can obtain a brochure by emailing conference@iadms.org or by calling the Harkness Center for Dance Injuries at 212-598-6022.

Benefits of joint-membership in IADMS and APTA's PASIG

- Add a new dimension to the care of dancers with whom you work.
- Network with other professionals in the field, expanding your resource & referral base.
- Enjoy discounted rates on specialty journals, resource guides, and conference tuition.
- Learn about the most-current trends and practices in performing arts PT through continuing education courses, quarterly newsletters, & website postings.

Marijeanne Liederbach, MSPT, MSATC, CSCS
Director of Research & Education
Harkness Center for Dance Injuries

GET INVOLVED IN THE PASIG AND THE FUTURE IS YOURS!

Join your fellow PASIG members in becoming an ambassador for the Performing Arts! The PASIG wants to encourage all our members to become actively involved by serving as committee members, regional directors, officers, and by offering your input at business meetings and through communication with other PASIG members. Remember, when you give of your time and energy to the PASIG, it's like giving a gift to yourself! The PASIG is only as strong as its members.

COMMITTEE UPDATES:

Committee objectives are formally outlined and described below. The committees are responsible for fulfilling and carrying out the PASIG's purpose and objectives. All committees will meet with the president in April/May to develop strategic plans for the year. Committee membership involves a 3-year commitment. Some committees still need members. If you have an interest in committee involvement, please contact the Committee Chairperson, who is listed in the Directory on the last page of this newsletter.

PRACTICE COMMITTEE

PURPOSE: To develop, in coordination with the membership, practice guidelines and standards for performing arts physical therapy; To assist in development and implementation of student affiliations as well as advanced clinical training; To serve as an advocate for performing arts physical therapy practice issues; To facilitate communication among members regarding practice patterns and exchange of clinical information.

OBJECTIVES: (1) Assist the practice analysis steering committee in the development of a Description of Specialized Practice for Performing Arts Physical Therapy; (2) Develop, maintain, and disseminate a list of active student affiliation and mentorship sites; (3) Act as a liaison between the PASIG and appropriate governing authorities regarding interstate

practice licensing issues; (4) Develop a compendium of current information regarding interstate licensing issues; (5) Develop a universal screening tool(s) for use with the performing arts community; (6) Act as a clearinghouse for exchange of clinical information among clinicians.

ROLES: 4 members; Estimated time commitment of 8 hrs/quarter.

NEEDS: 2 members

2000-2001 Activities: Facilitating the continuation of the Practice Analysis of Performing Arts for Physical Therapy, including aspects related to funding, scheduling/arranging meetings and maintaining contact with content experts of the National Advisory Group.

EDUCATION COMMITTEE

UPDATE: We are in the process of planning for next year's CSM programming. We will be offering a preconference course on dance in addition to our regular programming. Some ideas for regular programming include: specific tissue changes that occur in the UE of musicians with chronic overuse injuries; treatment strategies of performing arts clinicians that are evidence-based; help in getting started in establishing yourself as a performing arts physical therapist; familiarizing yourself with basic dance and movement vocabulary, eg, types of dance forms, musical instruments as well as common problems encountered when treating the performing artist. I am still looking for members to help with the programming. If you would like to serve on the education committee or if you have programming ideas, please contact me. I would love feedback on the above ideas.

Lynn Medoff

PURPOSE: To develop and coordinate 3 hours of annual Combined Sections Meeting programming for PASIG membership; To coordinate with Research Committee for 1 hour of annual "Dialogues in Performing Arts Research" programming.

OBJECTIVES: (1) Develop annual programming concepts; (2) Identify, solicit, and obtain commitments from potential speakers; (3) Coordinate program planning and speaker responsibilities; (4) Implement programming at CSM.

ROLES: 2 members; Estimated time commitment of 10 hrs. in the 1st and 2nd quarters; 3 hrs. in the 3rd & 4th quarters.

NEEDS: 2 members

2000-2001 activities: Arranged educational programming for CSM 2001.

RESEARCH COMMITTEE

UPDATE: The purpose of the research committee is to provide consultation to APTA members in the clinical or academic communities who request assistance or advisement with research activities: to facilitate clinical research in performing arts physical therapy throughout the country and to work closely with the education committee, assisting them with projects including staffing presentation slots at CSM. This is a good opportunity for anyone who enjoys presenting case studies and research in a professional forum setting. All committee members are friendly and cooperative, sharing ideas and information is helpful for anyone who likes to network for information from others with experience. The PASIG is interested in new members who would like to write abstracts of current performing arts research for publication in the JOSPT. We believe the education of colleagues through exposure to performing arts physical therapy research will draw attention to the specialized area and expand membership. We hope to hear from you!

Lisa Sattler

PURPOSE: To facilitate research in physical therapy for the performing arts; To facilitate dissemination of research relevant to performing arts physical therapy.

OBJECTIVES: (1) Develop annually 1 hour of "Dialogues in Performing Arts Research" programming; (2) Coordinate "Dialogues" programming with education committee; (3) Develop specific mechanisms for promoting and facilitating performing arts physical therapy research.

ROLES: 2 members; Estimated time commitment of 2 hrs. in the 1st and 2nd quarters; 3 hrs. in the 3rd and 4th quarters.

NEEDS: 1 member

PUBLIC/MEDIA RELATIONS COMMITTEE

PURPOSE: To raise awareness of Performing Arts Physical Therapy within the physical therapy profession, the performing arts community, and the public at large; To assist members in marketing their services to the performing arts community; To act as a clearing house for clinical pearls, regional news, and specific membership achievements; To act as an ambassador for performing arts clinicians.

OBJECTIVES: (1) Develop the quarterly regional news column (published in *OPTP*); (2) Collect a compendium of performing arts physical therapy articles suitable for publication/media release; (3) Facilitate development of PASIG special topic advisories; (4) Develop a media plan for disseminating press releases, special topic advisories, and specific articles regarding performing arts physical therapy, to our target markets.

ROLES: 4 members, Estimated time commitment of 3 hrs/quarter.

NEEDS: 1 member

MEMBERSHIP COMMITTEE

UPDATE: The membership committee will be working to increase their outreach to all present and potential members of the PASIG. The present membership directory is currently being updated and we are encouraging other PT members in the IADMS and other performing arts organizations to consider becoming PASIG members as well. The network of Regional Directors is continuing to evolve and this group will be working to continue to distribute information especially concerning the Practice Analysis to the membership. In addition, YOU are encouraged to contact your Regional Director or myself with any information about yourself, your practice and how the PASIG could better serve your professional needs or development. I am currently in need of two

committee members, 1 Regional Director for the Northwest and 1 Regional Director for the West.

Susan Guynes

PURPOSE: To develop outreach mechanisms to increase retention of current members and recruitment of new members.

OBJECTIVES: (1) Update membership directory every 2 years in coordination with Orthopaedic Section office, and the PASIG Education Committee; (2) Develop welcome package for new/returning PASIG members, and implement a mechanism for timely dissemination; (3) Regularly update PASIG Web Page in coordination with Orthopaedic Section office; (4) Coordinate annual PASIG Social Event at CSM.

ROLES: 2 members; Estimated time commitment of 6 hrs/quarter

NEEDS: 2 members, 1 Regional Director for the West and 1 for the Northwest

Activities: Newly formed in 2001. Has begun development of a membership welcome packet and has added the Regional Directors to its responsibilities.

Regional Directors: Now a Subcommittee of the Membership Committee

PURPOSE: To highlight regional activities of the performing arts physical therapy community, and PASIG members in particular; To foster communication and interaction among PASIG members; To act as an ambassador for the PASIG Executive Board to the region's members.

RESPONSIBILITIES: (1) Directly contact regional PASIG members on a quarterly basis to obtain and exchange PASIG information and news; (2) Report back to the Membership committee Chair; (3) Maintain accurate contact information on regional members and coordinate that information with the directory.

ROLES: 12 directors (2 per region); Estimated time commitment of 3-hrs/ quarter

NEEDS: 1 for the Northwest and 2 for the West Regions

The country has been divided into 6 regions as follows:

Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New York, Vermont)

Mid-Atlantic (Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, Washington DC, West Virginia)

South (Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, South Carolina, Tennessee)

Central (Arkansas, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, Oklahoma, Wisconsin)

Northwest (Idaho, Montana, Nebraska, North Dakota, Oregon, South Dakota, Washington, Wyoming)

West (Alaska, Arizona, California, Colorado, Hawaii, Nevada, New Mexico, Utah, Texas)

NOMINATING COMMITTEE

PURPOSE: To support the growth and development of the PASIG by recruiting candidates with a variety of performing arts experiences. Such diversity may be reflected with respect to practice setting, geographical region, and skill level of patient population; To act as ambassador of the Performing Arts SIG to the physical therapy community at large.

OBJECTIVES: (1) Develop and publish a slate of candidates for relevant positions on annual basis; (2) Conduct elections in accordance with PASIG Bylaws; (3) Chairperson to serve as liaison to Executive Board.

ROLES: Elected position for 3-year term; senior member serves as Chairperson; Estimated time commitment of 4 hrs/quarter.

NEEDS: Candidates needed on annual basis; a new member is elected annually.

PASIG EXECUTIVE COMMITTEE

President:
Jeff Stenback, PT, OCS
Orthopedic Rehabilitation Specialists
8720 North Kendall Dr, Ste 206
Miami, FL 33176
Ph: 305.595.9425 / FAX: 305.595.8492
Email: jsptocs@aol.com

Vice President:
Lynn E. Medoff, MPT, MA
1428 Mariposa Rd.
Flagstaff, AZ 86004
Ph: 928.853.4747 / FAX: 928.527.8601
Email: lmedoff@hotmail.com

Treasurer:
Jennifer (Adrienne) McAuley, PT, OCS
7830 Old Georgetown Rd., Ste C-15
Bethesda, MD 20814-2432
Ph (W): 301.656.0220 / FAX: 301.654.0333
Ph (H): 301.608.9030

Secretary:
Susan C. Guynes, MHS, PT
Department of Physical Therapy
LSU – Health Sciences Center
1900 Gravier Street, 7th Fl.
New Orleans, LA 70112-2262
Ph: 504.568.3434 / FAX: 504.568.6552
Email: sguyne@lsuhsc.edu

COMMITTEE

Education Committee Chair:
Lynn Medoff, MPT, MA
(contact information at left)

Practice Committee Chair:
Marshall Hagins, PT, PhD
Division of Physical Therapy
Long Island University
Brooklyn, NY 11201
Ph (W): 718.488.1489 / FAX: 718.780.4524
Ph (H): 718.398.1897
E-mail: mhagins@titan.liu.edu

Nominating Committee Chair:
Shaw Bronner, PT, MHS, OCS
Soar Research at Long Island University
122 Ashland Pl. #1A
Brooklyn, NY 11201
Ph (W): 718.246.6377
FAX: 718.246.6383
E-mail: sbronner@liu.edu
Members: Julie O'Connell, PT; Amy Frank, PT

Public/Media Relations Committee Chair:
Jennifer (Adrienne) McAuley, PT, OCS
(contact information at left)

Regional Directors
(Subcommittee of Membership Committee)

- **Northeast** (CT, MA, ME, NH, NY, RI, VT)
  Marshall Hagins, Marijeanne Liderbach
- **Mid-Atlantic** (DE, DC, MD, NC, NJ, PA, VA, WV)
  Tara Jo Manal, Laura Schmitt
- **South** (AL, FL, GA, KY, LA, MS, SC, TN)
  Edie Shinde, Jeff Stenback
- **Central** (AR, IL, IN, IA, KS, MI, MN, MO, OH, OK, WI)
  Mark Erickson, Julie O'Connell
- **Northwest** (ID, MT, NB, ND, OR, SD, WA, WY)
  Cheryl Ambroza
- **West** (AK, AZ, CA, CO, HI, NV, NM, UT, TX)
  Needs volunteers

Membership Committee Chair:
Susan C. Guynes, MHS, PT
(contact information at left)

Research Committee Chair:
Lisa Sattler, PT
1140 First Ave. Apt. 6
New York, NY 10021-7961
Ph: 212.838.6847
Members: Scott Stackhouse

Pain MANAGEMENT

SPECIAL INTEREST GROUP • ORTHOPAEDIC SECTION, APTA, INC.

President's Corner

Joe Kleinkort, PT, MA, PhD, CIE

LET THERE BE LIGHT

"One of the greatest pains to human nature is the pain of a new idea." Walter Bagehot

Quietly, in 1999 the FDA passed new legislation that would finally allow for easier less expensive qualifications for new devices in the medical arena. This has opened the door to one of the most beneficial devices on the world market for the past 25 years, the Low Level Laser Therapy (LLLT) device. I originally used the laser for treatment of chronic pain while in practice in the USAF and subsequently wrote about it in various articles and finally in a chapter in the First Edition of Thermal Agents in Rehabilitation.[1] At that time we were using a 1 mw laser transmitted through a fiber optic getting significant results in many chronic pain conditions, inflammatory MSDs and certain isolated cases of arthritis as well as wound healing. There have literally been thousands of studies done on the laser in the rest of the world but little has been done in the U.S. due to the prohibition by the FDA until now. In my entire 35 years as a physical therapist the one overall best modality I have ever used in the treatment of pain, inflammation, and tissue healing is LLLT.[2] With the advent of the use of laser diodes that can have an intensity all the way past 500 mw, we are able to reach the entire spectrum of applicability in therapy. Although the present devices are rather costly, I do believe the next generation of devices that will come out will be more cost sensitive and less cumbersome.

The first company to receive FDA approval was Bales Scientific, for their Photonic Stimulator. The next company to receive approval was the Anodyne Therapy System followed by Erchonia, and then the Microlight 830, for their study on carpal tunnel. I hope that over the next months we will be able to share some of the pros and cons of each system so that you can make a better decision on these types of modalities.

It is truly a breath of fresh air that we finally can see adjunctive tools that we can use to modulate pain in the therapy arena after such a long hiatus. I gladly would ask those of you who have had positive or negative experiences with these new modalities to share them in the form of case studies of just anecdotal reports. I encourage each of you to send in your thoughts and ideas that are of interest to the rest of those in the Orthopaedic Section who work with patients with chronic pain.

We also are looking at the possibility of doing a home study course for the Section on Chronic Pain Management. Please send in your ideas and topics that you would be interested in contributing directly to my email address: indusrehab@aol.com.

REFERENCES

1. Seitz L, Kleinkort JA. Low-Powered Laser: Its Application in Physical Therapy. In: Michlovitz S L, Wolf SL, ed. *Thermal Agents in Rehabilitation*. Philadelphia, Pa: FA Davis; 1986.
2. Kleinkort JA, Foley RA. Laser acupuncture: Its use in physical therapy. *Am J Acupuncture*. 1984;12:51.

Physical Therapy and Pediatric Chronic Pain

Scott Van Epps PT, PCS, ATP

ABSTRACT

Physical therapists often receive referrals to evaluate and treat children with chronic pain. The combination of the complex pain experience with a developing child often leaves therapists mystified. The therapist needs to be aware of what unique characteristics a child and his family bring to the evaluation and appropriate selection of treatment intervention. This review briefly discusses the uniqueness of pediatrics and the importance of a multidimensional approach to children with chronic pain. The review raises important questions related to physical therapy management of pain in children. The review ends by identifying areas for future research.

Clinicians often describe the treatment of chronic pain as complex and frustrating. As recently as the 1980s, researchers and clinicians debated if children experience pain.[1] Research and clinical practice provide evidence that children do in fact experience pain. Review of the literature illustrates a lack of clarity on the prevalence of chronic pain

amongst children. Epidemiological studies estimate 15% to 20% of children experience chronic pain.[2,3] Common chronic pain disorders in children include, but are not limited to: fibromyalgia, complex regional pain syndrome, arthritis, and abdominal pain.

The subjectiveness of pain combined with the limited cognition and verbal skills of children often frustrate health care professionals. Physical therapists and other health care professionals who have the responsibility of treating these children need to pay close attention to: (1) cognitive level of the child, (2) family dynamics, (3) psychological impact of pain, and (4) family acceptance of the pain management strategies.[4] These unique characteristics of pediatrics play an important role in physical therapy, especially in children who have chronic pain.

The importance of incorporating not only the child but also the family into the health care model needs to be stressed. The family-centered care model allows clinicians to develop a treatment plan with the family's goals as the center point. Review of the literature shows a trend amongst clinicians to combine family-centered care with a multidisciplinary team approach to treat chronic pain in children.[5] A multidisciplinary team approach used for pediatric chronic pain includes pharmacological, cognitive-behavioral, and rehabilitation interventions. Physical therapy for chronic pain disorders in children commonly occurs in and across the outpatient, and inpatient rehab settings, home, or the child's educational environment.

The evaluation and examination of the child should encompass not only the medical history, systems review, tests and measures, but also a conscious inventory of the child's environments. The unique settings for children often include the home, school, and community. Physical therapists must determine each of these settings' unique characteristics and how they impact the individual's pain experience. Culture, peer interactions, social groups, and academic requirements are a few of the many unique characteristics from these settings. Incorporating these variables in the examination produces a functional and comprehensive approach to the assessment of the child with chronic pain.

Physical therapists may use any combination of the established reliable and valid pain examination tools. The pain assessment tools give the clinician a better understanding of the child's pain experience within and across all environments. Pain assessment tools vary from investigating one dimension to multidimensions of the pain experience. The Visual Analogue Scale, a one-dimensional tool, measures an individual's perception of the intensity of the pain. The Pediatric Pain Questionnaire, a multidimensional tool, measures a variety of effects of the pain experience.

Interventions used by the physical therapist to treat chronic pain in children include therapeutic exercise, manual therapy, electrotherapeutic modalities, and other physical agents. Modalities may include transcutaneous electrical nerve stimulation (TENS), interferential stimulation, ultrasound, heat, and cold. Other interventions referred to in the literature include environmental adaptations, physical retraining, and behavioral strategies.[6] Clinicians may not feel comfortable using electrotherapeutic modalities or physical agents with children. The cognitive level or verbal skills of children may make safety a concern for some clinicians. However, this may be doing a disservice to the child who is not receiving the interventions. Physical therapists can increase their confidence in using these interventions with children through a rigorous review of precautions and contraindications and through establishment of controlled trials with these modalities and children. Neither a comprehensive summary of precautions and contraindications specific to children nor clinical trials of the outcomes and effects of physical agents and electrotherapy modalities were found in the current literature.

Review of the literature shows anecdotal reports on physical and occupational therapy for chronic pain in children.[6] The anecdotal research describes examination, evaluation, and interventions commonly used by physical therapists. Case reports referring to physical therapy as one of the interventions have been published on reflex sympathetic dystrophy in children.[7,8] No pediatric clinical trials of physical therapy examination, evaluation, and/or intervention were found using the standard and acceptable medical electronic search techniques. To understand the effectiveness and appropriateness of physical therapy in treating children with chronic pain, clinical trials need to occur. Placebo and controlled studies specifically aimed at interventions will help clinicians better understand childhood chronic pain disorders and how to improve physical therapy outcomes.

Besides clinical trials, clinicians can address the unknown of pediatric chronic pain by sharing their experiences. Clinicians can bring forth their experiences through retrospective record reviews, case studies, and continuing education programs. Retrospective record reviews may examine, organize, and review clinicians' decision-making to enhance future outcomes. Review of records can investigate how the multidisciplinary team examined and intervened to address the multi-environment impact on the individual's pain experience. Case studies on various chronic pain disorders in children provide a useful tool to establish trends and patterns of care. Continuing education programs designed to review the physical therapy management and specific barriers in pediatric chronic pain would benefit physical therapists. The opportunity for physical therapists to share experiences through research, education programs, and networking promotes positive outcomes and interests for further research.

The future of pain relief in children looks promising if the research continues to grow. Physical therapists should continue to emphasize the importance of family-centered care combined with a multidisciplinary team approach. Physical therapists need to integrate a focused analysis of current pain literature with the evidence they observe in their practice of physical therapy with children in pain into testable hypotheses for research. As we become more knowledgeable about pediatric chronic pain our frustration

will decline and we will be able to improve the quality of life of the child and their family.

REFERENCES

1. Schechter NL. The undertreatment of pain in children: an overview. *Pediatr Clin North Am.* 1989;36:781-795.
2. Perquin CW, Hazebroek-Kampschreur AA, Hunfeld JA, et al. Chronic pain among children and adolescents: Physician consultation and medication use. *Clin J Pain.* 2000;16(3):229-235.
3. Goodman JE, McGrath PJ. The epidemiology of pain in children and adolescents a review. *Pain.* 1991;46:247-264.
4. McClain BC. Chronic pain in children: issues in recognition and management. *Pain Digest.* 1996;6(2):71-76.
5. Zeltzer L, Bush JP, Chen E, Riveral A. A psychobiologic approach to pediatric pain, Part II: prevention and treatment. *Curr Probl Pediatr.* 1997;27:263-284.
6. Engel JM: Physical therapy and occupational therapy for pain management in children. *Child Adolescent Psychiatr Clin North Am.* 1997;6(4):817-827.
7. Papadopoulos GS, Xenakis TA, Arnaoutoglou E, Tefa L, Kitsoulis PB. The treatment of Reflex Sympathetic Dystrophy in a 9 year-old boy with long standing symptoms. *Minerva Anestesiol.* 2001;67(9):659-663.
8. Kesler RW, Saulsbury FT, Miller LT, Rowlingson JC. Reflex sympathetic dystrophy in children: treatment with transcutaneous electrical nerve stimulation. *Pediatrics.* 1988;82(5):728-732.

PAIN MANAGEMENT SPECIAL INTEREST GROUP BOARD LISTING

PRESIDENT
Joseph A. Kleinkort, PT, MA, PhD, CIE
303 Inverness
Trophy Club, Texas 76262-8724
PH: 817-491-2339
FX: 972-887-0294
indusrehab@aol.com

VICE PRESIDENT
John E. Garzione, PT, AAPM
PO Box 451
Sherburne, NY 13460-0451
PH: 607-334-6273
FX: 607-334-8770
jgarzione@juno.com

SECRETARY
Elaine Pomerantz, PT
20 Brookwood Road
South Orange, NJ 07079

Animal Physical Therapist

SPECIAL INTEREST GROUP

Orthopaedic Section, APTA, Inc.

ANIMAL PHYSICAL THERAPIST SPECIAL INTEREST GROUP
DIRECTORY OF OFFICERS & CHAIRPERSONS

President
Cheryl Riegger-Krugh, PT, ScD
Physical Therapy Program
C-244 4200 E. Ninth Ave
University of Colorado
Health Sciences Center
Denver, CO 80262
Work: 303-372-9141
Fax: 303-372-9016
E-mail: cheryl.riegger-krugh@uchsc.edu

Vice President and International Liaison
David Levine, PT, PhD
Department of Physical Therapy
University of Tennessee at Chattanooga
615 McCallie Avenue
Chattanooga, TN 37403
Home: 423-886-1098
Work: 423-755-5240
Fax: 423-785-2215
E-mail: david-levine@utc.edu

Treasurer
Nancy Murphy, PT
PO Box 6386
Ketchum, ID 83340
Home: 208-788-9215
Work: 208-727-8253
E-mail: nmurphy@svidaho.net

Secretary and Public Relations Coordinator
(Newsletter, Logo, Brochure)
Stephanie Fagin, PT
6540 Emigration Canyon
Salt Lake City, UT 84108
Work: 801-231-2543
E-mail: steph.jsilver@aros.net

Committee on Practice
Caroline Adamson, PT, MS
Colorado Canine Sports Medicine/Rehabilitation Clinic
Alameda East Veterinary Hospital
9870 E. Alameda Avenue
Denver, CO 80231
Work: 303-366-2639
FAX: 303-344-8150
E-mail: carolineadamson@juno.com

Clinical Competency Subcommittee
Nancy Ford, PT
900 Clintonville Road
Wallingford, CT 06492
Home: 203-981-1055
Work: 203-265-1975

Chair of Education
Kristinn Heinrichs, PT-SCS, PhD, ATC, CSCS
P.O. Box 61281
Savannah, GA 31405
Phone: 912-921-7346
FAX: 912-921-7350
E-mail: kheinrichs@cstone.net

Newsletter Coordinator
Arlene White, PT
HorsePower Equine Sports Therapeutics, Inc.
2457 "C" Road
Loxahatchee, FL 33470
Home: 561-792-1441
Fax: 561-792 - 1939
E-mail: ArlyFAMU96@aol.com

State Liaison Coordinator
Siri Hamilton, PT, LVT
University of Tennessee College of Veterinary Medicine
Dept. of Small Animal Clinical Services
2407 River Drive
Knoxville, TN 37901-1071
Home: 865-573-7356
Work: 865-974-2993
E-mail: sirivtpt@utk.edu

Nominations Committee
Deborah M. Gross, MSPT, OCS
Wizard of Paws
15 High Field Lane
Chester, CT 06412
Phone: 860-526-7840
Fax: 860-526-7841
E-mail: wizofpaws@aol.com

PTA Representative
Angela D. Frye-Lewelling, PTA
235 Douglas Dam Road
Kodak, Tennessee 37764
Work in human practice:
(865) 429-6584
Work in animal practice
(865) 974-2993
E-mail: K9LPTA@ aol.com

Orthopaedic Section Board Advisor
Joe Godges, DPT, MA, OCS

SIG Coordinator and Off-Site Continuing Education Coordinator
Stefanie Snyder

CALENDAR OF EVENTS

The home study course BASIC SCIENCE FOR ANIMAL PHYSICAL THERAPISTS is still available. Contact 877-766-3452 for more information.

THE ANIMAL PHYSICAL THERAPIST SPECIAL INTEREST GROUP (ANIMAL SIG) UPDATE

Orthopaedic Section member and nonmember directories are available through the Section Office 800-444-3982 Fax: 608-788-3965 or e-mail: ssnyder@centurytel.net; there are currently 544 members.

State Liaisons: To date there are 33 states that have Animal SIG Liaisons. Contact Siri Hamilton for further information 865-974-2993 or e-mail: sirivtpt@utk.edu.

The APTA has a web site that lists all of the State Practice Acts: www.apta.org/advocacy/state/state-practice

NETWORKING IDEAS: Colorado Animal Rehabilitation Study Group

Working day-to-day in an unfamiliar environment, such as a veterinary hospital, without other colleagues to consult can become frustrating and intimidating. Whether already working full-time with animals or just considering the possibilities, many questions and issues are bound to arise. In Denver, we have started a study group made up of local physical therapists interested in animal rehabilitation. Primarily, our discussions revolve around dogs, but all species are welcome. Now about 40 members strong, we try to meet once every 6 to 8 weeks, varying the times and locales to fit all schedules the best we can, to discuss a variety of topics related to dogs. These topics range from therapeutic exercise, profit, orthopedics, orthotics, legal issues, or whatever is on someone's mind. It is kept very informal, sharing ideas, discussing cases, and networking. Real animals are occasionally brought to the meetings. Not surprisingly, most owners are more than willing to lend their animal as a discussion case or practice partner for such things as performing a neurological or physical exam. It is a great way to share information, meet others, and grow stronger in experience and confidence when working with animals. We would encourage you all to spread the word and join forces to support one another.

Caroline Adamson, MS, PT
Colorado Canine Sports Medicine/Rehabilitation Clinic
Alameda East Veterinary Hospital
9870 E. Alameda Ave.
Denver, CO 80231
Ph: 303-366-2639 ext. 239
carolineadamson@juno.com

Cheryl Riegger-Krugh, ScD, PT
University of Colorado Health Sciences Center
Physical Therapy Program
Campus Box C244
4200 East Ninth Ave.
Denver, CO 80262
Ph: 303-372-9141
cheryl.riegger-krugh@uchsc.edu

CASE STUDY

Marty Pease

On September 5, 2001, Carrie Adamson, PT from Alameda East Animal Hospital and Marty Pease, PT from Veterinary Referral Center of Colorado presented live case studies to a study group in Denver. The topic was bracing. Marty presented Gus who was struck by a car and suffered left radial nerve damage. Carrie presented Max whose hocks

have become hypermobile secondary to steroid use in treatment of lupus.

On 11/6/00 Gus was struck by a car on his left side. His main orthopaedic injuries were dislocated bilateral SI joints and radial nerve damage to his left front leg. At the time of the accident, Gus weighed 80 lbs. The following was his orthopaedic medical management.

Gus' SI joints were originally fused on 11/10/00 but it didn't hold. A revision was done on 11/16/01 when the implants were removed and external fixation was used to stabilize the joints. He also had a severe infection and the wound was debrided. Antibiotic beads were placed in the wound under the skin. At that time Gus weighed 65 lbs. It was noted he had poor withdrawal response in his rear legs but he had pain response. On 12/22/00 Gus was admitted to the Veterinarian Referral Center of Colorado for hardware removal. He weighed 60 lbs. At that time it was noted he had sensation on the palmar surface of his left metacarpal area and severe atrophy left front leg.

Gus was initially referred to animal rehabilitation on 12/28/00. He had a 3-legged gait, not using his left front leg. It was floppy in a flexed posture due to the lack of extensors from the radial nerve injury. Gus had significant atrophy throughout the left front leg and shoulder girdle. He was unable to support weight on the leg even if it was placed for him. He had full use of his rear legs. The scar in his pelvic area was very tight and he lacked right hip range of motion by 25%. His tail drooped and he could lift it occasionally to wag it. The owners reported he was unable to sit straight and he avoided sitting. The main goals of animal rehabilitation were to increase hip range of motion, decrease scar tightness, encourage use of left front leg, facilitate the recovery of the radial nerve, and protect the left carpus.

The first treatment consisted of showing the owners a home program, swimming, and electrical stimulation to the triceps and toe and carpus extensors. The home program consisted of range of motion exercises for the rear legs and the left front, scar mobilization techniques, and neuromuscular re-education of the left front leg (placing the leg with support and rocking him to facilitate weight bearing).

During the rehabilitation sessions, Gus was on the Swiss ball bearing weight on his elbows to promote shoulder stabilization. Gus also lay across the ball and was rocked forward to put weight on the front legs. The time on the ball was based on his tolerance, approximately 2 minutes. Gus played fetch in the pool for 15 to 20 minutes. When Gus was fatigued, the electrical stimulation was administered for 15 minutes with the pads placed over the radial nerve where it exited anteriorly and the other electrode was over the extensors.

A major component of Gus' care was getting a splint to stabilize his left carpal joint in a weight bearing posture. Initially the veterinarian fabricated one in the clinic. The problems with it were breakage and pressure sores. Eventually Gus was custom fit with a hinged splint which worked much better, but he continued to have problems with rub sores. The splint assisted Gus in being able to walk on the left front leg once he got active contraction of his triceps. The splint was redone again to make it much sturdier to prevent breaking because he used it so heavily.

Gus' progress was as follows. On 1/23/01 a response in the extensors with the electrical stimulation was elicited. On 2/1/01 Gus was able to tolerate sitting and also sat square. The owners reported Gus was nearly normal in the sense of attitude, appetite, and endurance. On 2/6/01 Gus was occasionally using his left front leg with walking. There was palpable triceps contraction and Gus reacted to the electrical stimulation implying a return of some sensation. He was last seen officially on 2/27/01. At that time, he was walking on all 4 legs with the brace. Over the 2 months of swimming, he built up muscle bulk through the shoulder girdle, into his neck and the triceps and his endurance doubled. Gus dropped by for a visit on 5/8/01. He weighed 76 lbs and had filled in. When he walked slowly he used the left front leg every step and when he ran he placed it every other step (with the brace on). He walked the Furry Scurry on 5/5/01, which was a 2-mile fund raiser. He is able to hold his tail up and wag it. The owners take him regularly to the dog park. On land, the other dogs can easily outrun Gus but in the water he is the faster dog. The owners reported that they have seen him actively extend his toes and when he stretches, extend his left carpus.

An ongoing problem Gus had is that if he is left unattended, he would chew at his foot due to the impaired sensation. He has chewed off his medial digit. The owners have managed this by kenneling him when they aren't home and the owner has rigged a device with 4-inch PCV that covers his entire front leg and straps around his shoulders.

Gus was seen twice a week for a total of 15 visits. His course of treatment was interrupted for surgical repair of his pelvic wound and management of open pressure sores from his splint. Treatment was discontinued because Gus was functional with his splint and the weather was nice enough that the owners could take Gus several times a week to the local dog park to swim.

CASE HISTORY - Bromiley M. Physiotherapy for Equine Injuries. Equine Veterinary Education. 1994;6(5):241-244.

A 10-year-old thoroughbred gelding with no previous history of lameness pulled up very lame on the left hind leg after completing a steeplechase in February 1993. Rectal examination by the veterinary surgeon confirmed a pelvic fracture (wing of the ilium). The case was referred for physiotherapy and given box rest, loose not restrained.

The aims of physiotherapy were to:

- Control pain
- Reduce edema in the left hind limb and sheath
- Prevent muscle atrophy in the left hind quarter
- Promote circulatory flow throughout the left hind quarter

The physiotherapeutic aims were achieved by use of the following regimen started 2 weeks after the initial injury.

1. Pain was controlled using a low level laser (Silbaru) 630nm over the relevant acupuncture points, once daily.
2. Edema in the left hind limb was reduced by encasing the limb in a "blow up" human splint, then placing the electrodes of a muscle stimulator over the muscles of the gaskin and activating these muscles with the limb encased. This treatment was given twice daily for 1 hour for 1 week after which the limb edema had resolved and treatment was stopped. At this time some edema remained but this reduced to normal after 2 weeks.
3. To minimize muscle atrophy, electrical stimulation of the left gluteal muscles, quadriceps, hamstrings, and iliopsoas was performed for 1 hour each day. Electrodes were placed in a manner which stimulated the gluteals and

quadriceps 1 day, iliopsoas the next, and hamstrings on the third day.

4. Pulsed magnetic field therapy was performed daily for 1 hour to promote circulatory flow through the left hindquarter.

The horse was let out for the first time on April 20th and after a further 5 weeks of in hand exercise he was turned out in a paddock for one month. The animal returned to training in July and for 2 months was worked from the ground only prior to resuming ridden exercise in September. In December 1993 the horse won his comeback race and has subsequently competed successfully at the highest level of National Hunt racing.

RESULTS OF THE ANIMAL THERAPY SURVEY

Conducted by David Levine

Sex: Male: 1 Female: 30

Age: 20-29 (3); 30-39(14); 40-49(10); 50+(4)

State(s) in which you practice: AZ(1); CO(1); CT(1); FL(7); IA(1); KY(1); LA(1); MA(1); ME(1); MD(1); MI(1); MT(1); NC(1); NE(1); NJ(1); NV(1); NY(4); UTAH(1); VA(1); WA(2)

Entry-level degree:
- Associate (3)
- Baccalaureate (19)
- Master (7)
- Doctor (2—PhD, ScD)

Highest degree:
- Associate (2)
- Baccalaureate (12)
- Master (11)
- Doctor (2—PhD, ScD)

Years practicing physical therapy:
0-9(14); 10-19(9); 20-29(5); 30+(2)

Years of APTA membership:
0-9(15); 10-19(8); 20-29(4); 30+(2)

Years of Orthopaedic Section Membership:
0-5(20); 5-10(5); 11+(1)

Current physical therapy practice status:
- FT (11)
- PT (8)
- PRN (3)
- Unemployed (5)

Current practice setting(s):
- Acute care hospital (1)
- Subacute or rehab hospital (2)
- Outpatient private practice (8)
- Outpatient hospital or corporate owned (6)
- Home health (5)
- Skilled nursing facility (2)
- School (1)
- Other (1-university faculty practice, 2-unemployed)

Animal Physical Therapy Practice

Which animals are you most interested in treating?
- Equine (13)
- Canine (23)
- Feline (5)
- Other

Which of the following best describes your interest in animal physical therapy?
- Academic (2)
- Treatment of my own, friends', or family's animals (free service) (5)
- Part-time practice in veterinary office, clinic, hospital, etc. (fee for service, working for DVM) (10)
- Full-time practice as above in C (4)
- Part-time private practice, self employed (any setting). (13)
- Full-time private practice as above in E. (10)
- Consultant (5)
- Other

Have you practiced physical therapy or rehabilitation with animals
- Yes (19)
- No (skip 14-19) (12)

Have you received compensation for your animal therapy?
- Yes (10)
- No (9)

Do you practice only by referral and under the supervision of a licensed veterinarian?
- Yes (12)
- No (8)

In which of the following settings have you practiced?
- Veterinarian's office, clinic, or hospital (11)
- Kennel, stable, or boarding facility (10)
- Client's home (11)
- Own home (8)
- Zoo (1)
- Farm (3)
- Competition (1)
- Circus
- Shelter (1)
- Other

Have you ever been injured while treating an animal?
- Yes (1-taloned by golden eagle)
- No (18)

Please indicate the types of conditions you have treated.
- Orthopaedic (18)
- Neurologic (10)
- Wounds (8)
- Pediatric (congenital, developmental, etc.) (3)
- Geriatric (arthritis, etc.) (10)
- Other (1-vestibular)

Which physical therapy interventions have you utilized in your treatment of animals?
- Ultrasound (8)
- Electrical stim (NMS, TENS, FES, HVG, IFC, etc.) (10)
- Infrared ultraviolet diathermy (1)
- Ultraviolet
- Diathermy
- Laser (3)
- Manual therapy (includes massage, STM, MFR, joint mobilization/ manipulation, CST, PROM, stretching, acupressure, etc.) (19)
- Hydrotherapy (whirlpool) (4)
- Aquatic therapy (swimming pool, underwater treadmill) (4)
- Gait training (11)
- Therapeutic exercise (15)
- Hot or Cold packs, baths or wraps (12)
- Magnets (2)
- Anodyne (2)
- Other (1-ionto, 1-feldenkrais, TTEAM)

Animal Physical Therapy Education

Ratings of the importance of the following subjects in your learning about animal physical therapy.

0 = not important; 1= somewhat important; 2= important; 3= very important; 4= extremely important, vital to the practice of animal physical therapy.

- Anatomy 1(1); 2(0); 3(1); 4(29)
- Physiology 1(2); 2(5); 3(6); 4(16)
- Biomechanics (osteokinematic, arthrokinematic, etc.) 1(0); 2(1); 3(2); 4(28)
- Gait analysis 1(0); 2(1); 3(2); 4(28)
- Analysis of movement tasks other that gait 1(1); 2(3); 3(6); 4(20)
- Evaluation (ROM, strength, appearance, skin integrity, posture deformity, girth, palpation, vital signs, functional impairments – to be consistent with the disablement/enablement and Guide to PT Practice) other objective observations/ measurement(s). 1(1); 2(1); 3(8); 4(20)
- Animal handling skills 1(1); 2(1); 3(6); 4(22)
- Pathology 1(2); 2(6); 3(12); 4(11)
- Differential diagnosis 1(1); 2(5); 3(12); 4(12)
- Electrical modalities (US, ES, IR, UV, etc, excluding laser) 1(5); 2(9); 3(13); 4(4)

Laser 1(8); 2(10); 3(6); 4(5)

Anodyne (nitric oxide mobilization) 1(7); 2(10); 3(4); 4(2)

Thermal modalities (hot, cold packs, baths, wraps, etc.) 1(2); 2(12); 3(11); 4(6)

Magnetic therapy 1(8); 2(14); 3(6); 4(0)

Manual therapy 1(2); 2(0); 3(7); 4(22)

Therapeutic exercise prescription type, progression, protocols, etc. 1(1); 2(0); 3(4); 4(26)

Aquatic therapy 1(3); 2(5); 3(8); 4(15)

Prosthetics/orthotics, assistive devices 1(5); 2(8); 3(11); 4(6)

Wound care 1(2); 2(8); 3(8); 4(11)

Nutrition 1(1); 2(12); 3(11); 4(5)

Neurology 1(0); 2(4); 3(18); 4(9)

Pharmacology 1(3); 2(11); 3(13); 4(4)

Respiratory therapy 1(6); 2(8); 3(10); 4(4)

Animal's occupational/environmental assessment 1(1); 2(6); 3(12); 4(12)

Established practices (referral patterns, forms, procedures, billing, etc.) 1(2); 2(10); 3(14); 4(5)

Marketing 1(3); 2(7); 3(14); 4(6)

State practices acts, legal issues 1(2); 2(2); 3(7); 4(20)

Other (networking)

Which of the following have you used to learn about and develop your animal therapy skills?

Adapting/modifying human physical therapy to animals (26)

Self-directed study via veterinary or other animal related text books, journals, or periodicals (26)

Mentoring by a physical therapist, veterinarian, veterinarian technician, or other experienced professional (14)

APTA remote site course(s) (16)

APTA home study course(s) (22)

APTA presentation at Combined Sections meetings (7)

Other courses (message, acupressure, MFR, equine therapy, etc.) (13)

Other learning experience (8)

Of the learning experiences in 20 above, which have you found most valuable or, which do you think would be most valuable in advancing your knowledge and practice of animal physical therapy?

1st (3); 2nd (3); 3rd (4); 4th (0); 5th (1)

1st (1); 2nd (4); 3rd (2); 4th (3); 5th (1)

1st (9); 2nd (2); 3rd (2); 4th (1)

1st (3); 2nd (5); 3rd (1); 4th (2)

1st (0); 2nd (1); 3rd (3); 4th (1); 5th (1)

1st (0); 2nd (0); 3rd (0); 4th (0)

1st (0); 2nd (2); 3rd (0); 4th (2)

1st (2); 2nd (1); 3rd (0); 4th (0)

(9) I believe all the above are equally valuable learning experiences

What do you believe the minimum requirements should be for a physical therapist to practice animal physical therapy?

Any licensed physical therapist (1)

A licensed physical therapist who has successfully completed course work in animal anatomy and physiology (13)

A licensed physical therapist who has been mentored by veterinarian or physical therapist with established credentials in animal physical therapy (10)

A licensed physical therapist who can document a predetermined number of hours working under the direct supervision of a veterinarian (9)

A licensed physical therapist who successfully completes a written exam (2)

A licensed physical therapist who successfully completes some process to be credentialed (14)

Other (1-vet course work and mentoring, 1-what about PTA's?)

What do you believe the minimum requirements should be for a physical therapist assistant to practice animal physical therapy?

Any licensed physical therapist assistant (0)

A licensed physical therapist assistant who has successfully completed course work in animal anatomy and physiology (8)

A licensed physical therapist assistant who has been mentored by a veterinarian or physical therapist with established credentials in animal physical therapy (12)

A licensed physical therapist assistant who can document a predetermined number of hours working under the direct supervision of a veterinarian (6)

A licensed physical therapist assistant who can document a predetermined number of hours working under the direct supervision of a physical therapist with established credentials in animal physical therapy, who is working under the direct supervision of a veterinarian (9)

A licensed physical therapist assistant who successfully completes a written exam (3)

A licensed physical therapist assistant who successfully completes some process to be credentialed (12)

Other (0)

Animal Physical Therapy Legal Issues

Which of the following has jurisdiction over the practice of animal physical therapy by a licensed physical therapist in your state?

Veterinary Board (17)

Physical Therapy Board (5)

Agriculture board (0)

Other (0)

I do not know (5)

It is illegal for a licensed physical therapist without credentials in veterinary medicine (ie, DVM, or certified veterinary technician) to treat animals in my state. (10)

Would a layperson ie, someone without credentials in a health profession be able to establish an animal physical therapy or rehabilitation facility in your state?

Yes (11)

No (10)

I do not know (9)

If yes, in 24 above, would this individual:

Be required to employ professionals licensed or certified to treat animals? (1)

Be legally able to treat animals personally? (2)

I do not know (6)

Does your physical therapy liability/malpractice insurance policy cover treatment of animal patients?

Yes (3)

No (19)

I do not know (7)

If no, in 27 above, is it possible for you to obtain a liability/malpractice policy for the treatment of animals?

Yes (4-need to contact company, private ins., assist/supervision of other PT)

No (1)

I do not know (19)

If criteria have been established and met for the certification of an animal physical therapist, do you believe there should be a direct access, without veterinarian referral for animal physical therapy?

Yes (12)

No (12)

I do not know (5)

If you have any further comments, questions, or concerns about legal or other animal physical therapy issues not covered by this survey.

"I would like to see some sort of mentoring, internship, or other program, possibly combined with long-distance learning, to take the APT student/practitioner through a comprehensive PT session."

THE SPECIALTY SECTIONS
of the
AMERICAN PHYSICAL THERAPY ASSOCIATION
Hereby Offer This

CALL FOR PARTICIPANTS

MULTISECTION PLATFORM AND POSTER PRESENTATIONS
APTA COMBINED SECTIONS MEETING
Tampa, Florida
FEBRUARY 12 - 16, 2003

Persons wishing to make poster or platform presentations of RESEARCH, SPECIAL INTEREST, CASE STUDIES, OR THEORY are invited to submit abstracts for consideration.

ELECTRONIC SUBMISSION OF ABSTRACTS IS AVAILABLE.
USE OF ELECTRONIC SUBMISSION IS RECOMMENDED.

AVAILABILITY OF INSTRUCTIONS AND FORMS, AND ELECTRONIC SUBMISSION, IS AVAILABLE AT
APTACSMABSTRACTS.WUSTL.EDU
OR BY LINK FROM THE APTA WEB-SITE.

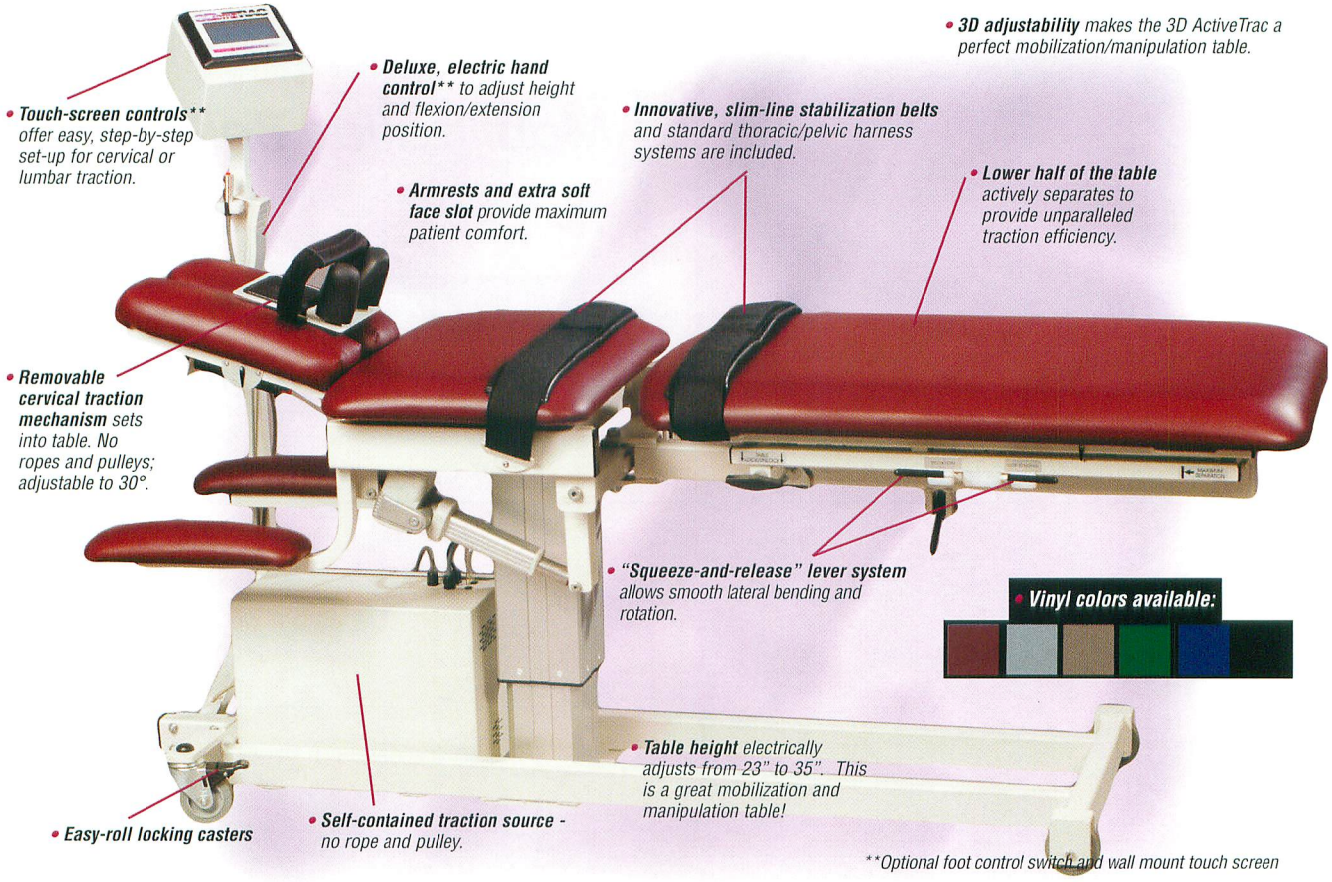
DEADLINE FOR RECEIPT OF ABSTRACTS IS TUESDAY, JULY 16, 2002.

Index to Advertisers

NEW!

SAUNDERS 3D ACTIVE TRAC®

Introducing the Most Advanced Traction, Mobilization/Manipulation and Treatment Table Ever Made



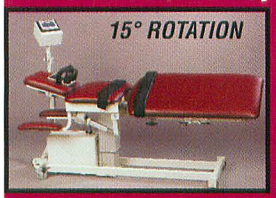
- **Touch-screen controls**** offer easy, step-by-step set-up for cervical or lumbar traction.
- **Deluxe, electric hand control**** to adjust height and flexion/extension position.
- **3D adjustability** makes the 3D ActiveTrac a perfect mobilization/manipulation table.
- **Innovative, slim-line stabilization belts** and standard thoracic/pelvic harness systems are included.
- **Armrests and extra soft face slot** provide maximum patient comfort.
- **Lower half of the table** actively separates to provide unparalleled traction efficiency.
- **Removable cervical traction mechanism** sets into table. No ropes and pulleys; adjustable to 30°.
- **"Squeeze-and-release" lever system** allows smooth lateral bending and rotation.
- **Vinyl colors available:**
- **Table height** electrically adjusts from 23" to 35". This is a great mobilization and manipulation table!
- **Easy-roll locking casters**
- **Self-contained traction source** - no rope and pulley.

**Optional foot control switch and wall mount touch screen

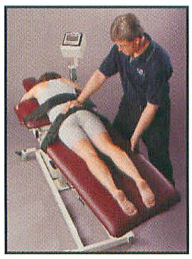
Discover how the 3D ActiveTrac can give you the widest range of therapeutic techniques for treatment.

Leasing Options Available

Smooth, Steady 3D Adjustments



All dimensions are adjusted with easy, one-handed controls. The clinician controls the position of the table and patient at the same time.



"The 3D ActiveTrac not only treats a wide variety of musculoskeletal disorders but at the same time reduces the physical stress and strain on the clinician."
- satisfied 3D ActiveTrac owner

Call toll free now for a FREE brochure at

1-800-779-0670

www.3DActiveTrac.com

THE SAUNDERS GROUP INC.

Orthopaedic Physical Therapy Practice
Orthopaedic Section, APTA, Inc.
2920 East Avenue South, Suite 200
La Crosse, WI 54601