ISAKOS

NEWSLETTER

WINTER 2004

Volume 8, Issue 1

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Join ISAKOS in Hollywood!

Abstract Deadline April 1 - Submit online at www.isakos.com

With the abstract application deadline quickly approaching, ISAKOS members have already begun submitting abstracts through the streamlined online system.

More than 1,000 abstracts were submitted for the 2003 Congress in Auckland; the 2005 Program Committee expects this year's number to be even higher, following a trend of total abstract submissions superceding those of the previous year.

Unbeatable Educational Value

The educational program will feature sessions on knee reconstruction, arthroscopy and joint preservation. The meeting will include surgical demonstrations, plenary sessions, hands-on workshops, topical symposia, hundreds of posters, technical exhibits, a multimedia center and panel discussions.

Pre-Congress Meeting

For the first time ISAKOS will offer a pre-congress meeting. The meeting will be on Saturday, April 2, 2005. The Advanced Surgical Demonstrations will feature well known surgeons performing advanced surgical procedures in small group demonstrations.

An International Gathering Place

ISAKOS Congress attendees will experience, once again, the extraordinary international exchange that takes place at this biennial gathering place. Members who have not attended a recent congress should make plans to attend in 2005. There is no other congress in this specialty that can offer such diversity and vibrancy.

A Meeting and a Vacation

The 2005 ISAKOS Congress will be held at the Westin Resort and Spa, a brand-new oceanfront resort in southern Florida. All sleeping rooms have intracoastal or ocean views. On its grounds sit an 18-hole championship golf course, tennis center, day spa and two marinas. Attendees will enjoy lavish swimming pools that boast two waterfalls, an infinity-edge and glass bottom.

See page 6 for complete abstract application guidelines.

GLOBAL CONNECTION

ISAKOS proudly announces three new corporate gifts to our Global Connection campaign.

TORNIER

ORTHOFIX ALWAYS INNOVATING

SAWBONES WORLDWIDE LEADERS IN ORTHOPAEDIC AND MEDICAL MODELS

BREG An ORTHOFIX Company

Thank you for your generous support!

See complete story on page 3

ISAKOS Welcomes New Members

ASSOCIATE MEMBERS

Sercan Akpinar, MD - Turkey • Al Husseiny, Orthopaedic Consultant, Saudi Arabia • Mahmut Argun, MD, Turkey • Georgios Babalis, MD, Greece • Sushrut Babhulkar, MS, Mch, India • Adad Baranto, MD, Sweden • Paul Baxt, MD, USA • Nicolas Bonin, MD, France • Julian Bourimborde, MD, Argentina • Gershon Chaimsky, MD, Israel • Jae-Yeong Cho, MD, Korea • Jose Colleoni, MD, Brazil • Andrea De Vita, MD, Italy • Fuat Duygulu, MD, Turkey • Robert Fain, Jr., MD, USA • Geraldo Granata, MD, Brazil • Tadayuki Hoshi, MD, Japan • Eero Hyvarinen, MD Finland • Luis Alberto Ibanez, MD Argentina • Eiji Itoi, MD Japan • Segarra Juan, MD Spain • Vitaly Kuksov, MD Prof Russia • James Linklater, FRANZ CR Australia • Augustus Mazzocca, MD USA • Mark Miller, MD USA • Joan Monllau, MD, PhD Spain • Ali Motamedi, MD USA • Hira Nag, MS India • Seisuke Nishimura, MD Japan • Takashi Ogiuchi, MD Japan • Keishoku Sakuraba, MD, PhD Japan • Luiz Seixas, MD Brazil • Robert Smigielski, MD Poland • Antonio Soler-Salas, MD USA • Kurt Spindler, MD USA • Stuart Springer, MD Usa • Yomei Tachibana, MD Japan • Mikihito Tamai, PhD Japan • Andrew Tan, MD, FRCS Singapore • Jeffrey Tedder, MD USA • Ajayakumar Thankappan, MBBS. D (orth) MS (orth) India • Milan-Alexander Toljan, MD Austria • Tomohiro Tomihara, MD Japan • Sanjay Trivedi, MS India • Akihiro Tsuchiya, MD Japan • Mehmet Tuncel, Assoc. Prof Turkey • Ewoud Van Arkel, MD, PhD Netherlands • Kazuyoshi Yagishita, MD, PhD Japan • Kengo Yamamoto, MD Japan • Toshiaki Yamamura, MD Japan • Hideki Yasunaga,. MD Japan • Jae Yoo, MD Korea

Editor's Note

Few Constants

Ronald M. Selby, MD, USA, 2003-2005 ISAKOS Newsletter Editor

There are precious few constants in orthopaedic surgery and in life. Outstanding among these is change. Throughout the ages change remains one of the towering constants. ISAKOS, your international association, embraces change. In fact, it thrives on it. With a membership of almost 1700 strong, the growth has increased 65% since 1995. Under the watchful eye and able hand of President Per Renstrom, the Board of Directors and staff, ISAKOS is entering a period of exponential growth. This very newsletter gets attention from orthopaedic surgeons and others worldwide. We welcome orthopaedic surgeons with an interest in advancing the science and education of arthroscopy, knee surgery and orthopaedic sports medicine to join ISAKOS. It will provide a fabulous learning experience, thought-provoking meeting, and friendships for a lifetime.

With this edition of the newsletter we bring you several interesting scientific articles as well as reports of many activities within ISAKOS. There are several reports from committees bringing you updates on their activities and projects. The Knee Committee has been actively involved in the planning of a consensus group meeting on the management of osteoarthritis of the knee prior to total knee arthroplasty to be held just prior to the AAOS meeting in March of 2004. I recommend the article summarizing the management of bicruciate lesions of the knee by Drs. James Rand and Philippe Neyret. An intriguing minimally invasive technique for repair of distal biceps tendon avulsion is presented by Gregory I Bain, MBBS, FRACS, Australia. Moises Cohen, MD, PhD, Brazil, has been quite busy in his capacity of Assistant Secretary of

Continued on page 26

President's Message

A Very Active ISAKOS

Per A. Renström, MD, PhD, Sweden, 2003-2005 ISAKOS President

ISAKOS is a very active organization and I feel it is important to update you regularly on our activities. Regular information gives you, the membership, a chance to voice your opinion and provide feedback. Constant activity and dialogue has allowed ISAKOS to emerge quickly as a significant international organization in our field. We consider ISAKOS to be one of the most exciting and attractive international societies.

The educational and scientific activities of our members are of the highest quality, yet we continually need to remind ourselves that ISAKOS represents a large spectrum of resources and education. There are many orthopaedic colleagues who work under less than optimal conditions. Our challenge is how can ISAKOS provide support to improve their education and clinical work?

As ISAKOS moves forward, our society can and should take the initiative in questions like these. It is my strong feeling that ISAKOS can make a difference.

Our efforts include:

- Support education in our field for colleagues and their coworkers in the underdeveloped nations, not only in basic education, but also in specialization and practical work.
- Develop consensus studies, then publish and disseminate reports on current knowledge and techniques.
- Encourage members to have open communication with fellows and visitors from underdeveloped countries.

Continued on page 26

Join ISAKOS in Support of International Orthopaedic Education

ISAKOS' ***Global Connection: Expanding International Education*** campaign effort is an historic undertaking for our society and one that has proven important to both members and companies in our industry.

To date, ISAKOS has raised over US$3,245,000 from corporate supporters who agree that investing in international orthopaedic education in our specialties is important to surgeons, patients, and the industry overall. Tornier and Orthofix are two of the companies who recently answered the call for support, each pledging US$100,000. ISAKOS is proud to count Tornier and Orthofix among our corporate supporters and is also grateful to Sawbones (Pacific Research Laboratories) for pledging a campaign gift of US$25,000!

"The ISAKOS ***Global Connection*** campaign is a unique undertaking and one Tornier is proud to support," said Alain Tornier of his firm's recent commitment. "Ongoing education in the ISAKOS specialty areas is vital in Europe, in North America and throughout the world. We are happy to be part of this special initiative."

Our members are also actively supporting the effort, some by serving as campaign leaders and fund raisers. And ALL members are important in helping us reach our financial goal of US$5 million!

In the latter part of 2003, members were mailed information about the ***Global Connection*** campaign and asked for support via a financial pledge. To date, ISAKOS has raised over US$71,000 from members! Many thanks to all those who made a campaign commitment to increase educational opportunities in our field!

As the ***Global Connection*** initiative is so important to the future of ISAKOS, we will be recognizing contributors to the campaign effort in several special ways. These include:

- Name recognition in the ISAKOS newsletter and on the website

Continued on page 12

Please visit www.isakos.com and follow the campaign links to learn more about the campaign. If you have not yet made your gift, please download your pledge form today!

Global Connection Corporate Founding Donors

President's Circle - $500,000 +

smith&nephew

stryker® CORPORATION

Ambassador's Circle - $250,000 +

AIRCAST® INCORPORATED

Arthrex®

dj ortho™

BIOMET ARTHROTEK® A Biomet Company

zimmer Confidence in your hands™

Director's Circle - $100,000 +

Mitek WORLDWIDE A division of ETHICON, INC. a Johnson & Johnson company

centerpulse Implanting trust.

ORTHOFIX® ALWAYS INNOVATING

BREG An Orthofix Company

TORNIER

Patron's Circle - $50,000 +

ArthroCare®

Benefactor's Circle - $25,000 +

SAWBONES® WORLDWIDE LEADERS IN ORTHOPAEDIC AND MEDICAL MODELS

Knee Committee Report

Philippe Neyret, MD, *Co-Chairman, France, and James Rand*, MD, *Co-Chairman*, USA

Philippe Neyret, MD, France

James Rand, MD, USA

The Knee Committee has been actively involved in the planning of a consensus group meeting on the management of osteoarthritis of the knee prior to total knee arthroplasty. The meeting will be held just prior to the AAOS meeting in March of 2004.

An international faculty will participate in the consensus group. Some of the topics to be discussed include the etiology of osteoarthritis, non-operative management options, cartilage replacement, meniscal transplantation, uni-spacer and osteotomy.

The consensus from that meeting will be provided to the membership at the ISAKOS Congress in Florida in 2005.

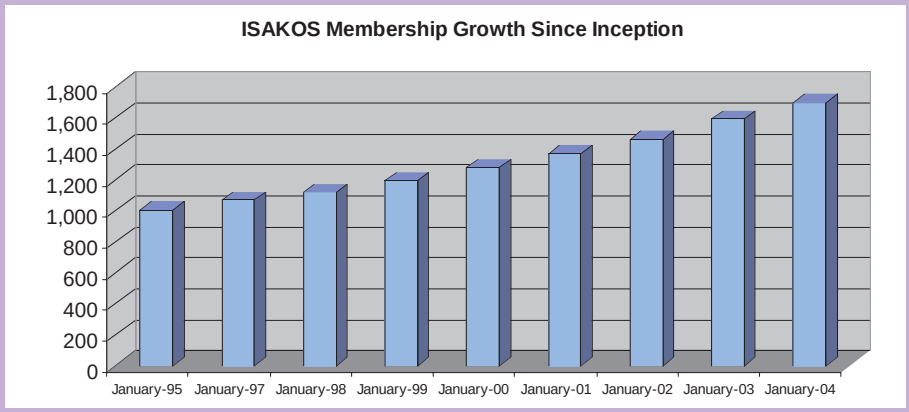
Additional projects include working with the Program Committee to prepare instructional courses and symposia for the Florida meeting. We participated in a roundtable on osteotomy about the knee, organized by Ron Selby for the web site. We prepared a summary on management of bicruciate lesions of the knee: it is part of this newsletter.

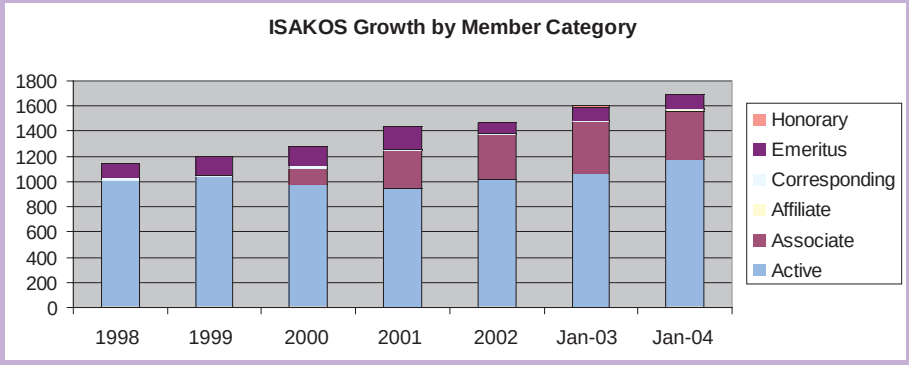
We welcome comments from the membership with ideas for future subjects for review.

MEMBERSHIP COMMITTEE REPORT

Luis A. Vargas, MD, *Chairman*, USA

ISAKOS continues membership growth! As ISAKOS increases its services for members, it continues to expand its membership. As an ISAKOS member, please continue to support and promote your society to your global colleagues.





Upper Extremity Committee Report

Philippe P. Hardy, MD, *Chairman, France*

The Upper Extremity Committee had a closed meeting in Paris on December 18-20, 2003. The topics discussed were "Guidelines for Biomechanical Testing of Upper Extremity Implants" and "Partial Articular Side Tear of the Rotator Cuff (PASTA Lesions)."

In addition, a study on the complications of upper extremity arthroscopies was offered this fall on the ISAKOS Web site. The retrospective study collected data from 75,000 arthroscopic procedures from 162 surgeons representing over 40 countries. The prospective study was completed and data was reviewed at the Paris meeting.

Orthopaedic Sports Medicine Report

Annunziato Amendola, MD, *Chairman*, USA

The Orthopaedic Sports Medicine Committee has been involved in developing topics for ICLs and symposia for the 2005 ISAKOS Congress. There are many evolving techniques and strategies in the area of sports medicine that we will be attempting to elucidate on at future meetings. Our last project, a monograph entitled *Evolving Strategies on the Diagnosis and Treatment of Tendinopathies*, was very timely and dealt with an important topic. We are thankful to the contributors, and the sponsorship of Aircast, Inc.

One of the main projects our committee will focus on this year will be issues and controversies associated with acute and chronic ankle instability. We have been discussing a possible consensus symposium on ankle instability, in conjunction with FIMS. Committee members are likely to consider many topics as they prepare a consensus statement for inclusion in the symposium; these topics will be reviewed at the next committee meeting in San Francisco. In addition to presenting a symposium, the committee hopes to produce a publication on the symposium topic for ISAKOS members. The publication will be distributed at the 2005 ISAKOS Congress in Florida.

The next meeting of the sports medicine committee will be in San Francisco at the AAOS meeting, on Thursday 8-11 am, in the Mendocino Room at the Palace Hotel. It will be very important to attend this meeting since this will be the only meeting prior to the 2005 ISAKOS Congress.

ISAKOS Office Moves

The ISAKOS Office has relocated from Danville to San Ramon, California. In accordance with the Society's progress, the office has expanded. San Ramon is ideally located in the San Francisco Bay area. The Executive Committee meeting will be held in the ISAKOS offices in March. Contact info is 2678 Bishop Drive, Suite 250, San Ramon, CA 94583-2338 USA.
Tel +1 925.807.1197 and Fax +1 925.807.1199

ISAKOS Committee Meetings

The Palace Hotel
2 New Montgomery Street
San Francisco, California 94105
March 9-11, 2004

Tuesday, March 9

Time	ISAKOS OFFICE 2678 Bishop Dr. Suite 250 San Ramon, CA
11:00 am - 6:00 pm	Executive Board Meeting and Finance Committee Meeting

Wednesday, March 10 The Palace Hotel

Time	MENDOCINO ROOM	NAPA ROOM	MONTEREY ROOM
7:00 am - 7:50 am	All Committee Chairs		
8:00 am - 9:00 am			Bylaws
8:00 am - 10:00 am	Communications	Membership	
9:30 am - 12:00 pm			Education
10:30 am - 12:30 pm		Site Selection	
10:30 am - 1:30 pm	Arthroscopy		
12:00 pm - 3:15 pm			Upper Extremity
1:30 pm - 4:30 pm		Strategic Planning	
2:00 pm - 4:30 pm	Newsletter Editorial Board		
3:30 pm - 6:00 pm			Knee

Thursday, March 11 The Palace Hotel

Time	MENDOCINO ROOM	SEA CLIFF ROOM	MONTEREY ROOM
8:00 am - 11:00 am	Orthopaedic Sports Medicine	Scientific	Strategic Advisory Task Force
11:00 am - 1:00 pm		Campaign Steering Committee	
11:00 am - 2:00 pm	Program Committee		
2:00 pm - 2:45 pm		Board of Directors Only	
3:00 pm - 5:00 pm		Board of Directors and All Committee Chairs	

AWARDS

ISAKOS offers several opportunities for researchers to receive recognition through the 2005 ISAKOS awards program.

The Richard B. Caspari Award
Sponsored by Mitek Worldwide

The Richard B. Caspari Award was established in 2003 at the Fourth Biennial ISAKOS Congress in Auckland, New Zealand, to reward the best upper extremity paper read at the scientific program of the congress.

A panel comprised of members of the ISAKOS Upper Extremity Committee will select two prize-winning papers in 2005. The winners will be announced in Hollywood, Florida at the awards ceremony and an honorarium will be awarded.

John Joyce Award
Sponsored by Smith & Nephew, Inc., Endoscopy Division

A cash prize will be awarded for the best arthroscopy paper read during the scientific program in Hollywood. All arthroscopy papers presented will be automatically considered for this award. Second and third place prizes will also be granted.

NEW AWARD

The Patellofemoral Research Excellence Award
Sponsored by The Patellofemoral Foundation, Inc.

This award has been established to encourage outstanding research leading to improved understanding, prevention and treatment of patellofemoral pain or instability. Applicants should submit six (6) electronic copies of the manuscript to the ISAKOS office by November 1, 2004. The decision will be made by a committee with representatives from the Scientific and Knee Committees of ISAKOS, the International PF Study Group, and The PF Foundation. The award consists of a $2,500 honorarium, presentation of the paper at the 2005 ISAKOS Congress, and possible publication in *Arthroscopy: The Journal of Arthroscopic and Related Surgery*, the official journal of ISAKOS.

The Patellofemoral Traveling Fellowship
Sponsored by the Patellofemoral Foundation, Inc.

This travel award is to promote better understanding and communication regarding patellofemoral pain. This opportunity will be available on a competitive basis to an orthopaedic surgeon interested in the study and advancement of understanding of the patellofemoral joint. Preference will be given to those who have established an academic track record. Applicants should submit a letter detailing their interest in the patellofemoral joint, together with their curriculum vitae (electronically) to the ISAKOS office by November 1, 2004. The Patellofemoral Foundation will provide a stipend to permit visits to several centers, worldwide, that offer opportunities to learn about the complexities of patellofemoral pain. The fellow will write a report of the experience which will be considered for publication in *Arthroscopy: The Journal of Arthroscopic and Related Surgery*.

APPLICATION DEADLINE - SEPTEMBER 1, 2004!

Achilles Orthopaedic Sports Medicine Research Award
Sponsored by Aircast, Inc.

An honorarium will be awarded to researcher(s) who have performed the most outstanding clinical or laboratory research in the field of orthopaedic sports medicine. Complete manuscripts must be mailed to the ISAKOS office by September 1, 2004. Download an application and review detailed instructions at www.isakos.com. Faxed and emailed submissions will NOT be considered.

APPLICATION DEADLINE - SEPTEMBER 1, 2004!

Albert Trillat Young Investigator's Award

An honorarium will be awarded to a young researcher who has done outstanding clinical or laboratory research contributing to the understanding, care or prevention of injuries to the knee. All applicants must be under 40 years old at the time of the 2005 Congress. Complete manuscripts must be mailed to the ISAKOS office for consideration by September 1, 2004. Download an application and review detailed instructions at www.isakos.com Faxed and emailed submissions will NOT be considered.

ABSTRACTS

Submit Your Abstract Online at www.isakos.com

Abstract Submission Guidelines

ISAKOS is happy to announce that abstracts for podium and poster presentation may be submitted directly to the ISAKOS Office online. *There is no paper form to complete and mail in.*

When you are ready to submit your abstract, visit the ISAKOS web site (www.isakos.com) and follow the instructions. You will want to have the following information at hand when you prepare to submit your abstract:

1. The complete contact information for all authors on the paper. It will help you if you know the ISAKOS Member ID Numbers of as many authors as possible. Member ID Numbers can be recorded from the ISAKOS Online Directory. Authors do not have to be ISAKOS members to submit an abstract.
2. The abstract. Authors can either type the abstract directly into the online form, or upload it. Please note: graphics and tables will not be accepted. Text submissions only.

Authors will also be asked to read and abide by the guidelines on the next page in order to be considered for presentation:

GENERAL GUIDELINES

1. Persons submitting an abstract to ISAKOS do so with the understanding that they and all authors listed on the abstract will abide by the conditions, deadlines, policies and decisions of the ISAKOS Board of Directors and Program Committee.
2. All abstracts for the ISAKOS Biennial Congress must be submitted ON LINE via the ABSTRACT APPLICATION FORM by 11:59 p.m. Pacific Standard Time on **April 1, 2004.** Abstracts will not be accepted after that date. Abstracts cannot be emailed separately to the ISAKOS Office; they must be submitted via the ISAKOS Web site through use of the online form.
3. The author must indicate on the abstract form if the abstract should be considered for paper, poster, or e-poster presentation. The ISAKOS Program Committee will make all final decisions on the mode of presentation. Efforts will be made to comply with the stated preferences.
4. Persons submitting an abstract to the ISAKOS must understand that all attending presenters, authors, faculty members, etc. will be expected to register for the meeting and pay all registration and travel costs. No exceptions will be made. If attendance is dependent on outside funding, please secure financial aid before submitting the abstract.
5. If the abstract is accepted for podium presentation, all presenters must speak in English and be prepared to answer questions from the audience in English.
6. Persons submitting an abstract to ISAKOS must agree to sign a Financial Disclosure Statement and an American Food and Drug Administration Statement. Although ISAKOS is an international society, it receives its CME accreditation from the American Academy of Orthopaedic Surgeons, and ISAKOS abides by their requirements. ISAKOS does not view the existence of disclosed interests or investments as necessarily implying bias or decreasing the value of the presentation. These disclosures will not be seen or taken into consideration when the abstract is considered for presentation.
7. Persons submitting an abstract to ISAKOS must sign a copyright transfer so that chosen abstracts can be published in the journal *Arthroscopy: The Journal of Arthroscopic and Related Surgery*, in the ISAKOS Final Program, on the ISAKOS Congress E-poster CD-ROM, which will be distributed to all congress attendees in an unalterable format; and online on the ISAKOS and *Arthroscopy: The Journal of Arthroscopic and Related Surgery* websites.
8. The same First Author may submit a maximum of 3 abstracts for consideration at the 2005 ISAKOS Congress.
9. No submitted abstracts will be returned to the authors, and all authors must agree to the General Guidelines as stated above.

Strategic Advisory Task Force & Executive Board Meeting Held in Hollywood, Florida, November 2003

Per A.Renström, MD, PhD, ISAKOS President 2003-2005

ISAKOS is presently very active and is in an exciting phase planning many new activities. The Executive Board and Strategic Advisory Task Force met at the Diplomat Hotel in Hollywood, Florida on November 6-8, 2003 to discuss and analyze ISAKOS business. The ISAKOS business discussed included the following:

- Membership Promotion
- Budgets
- Arthroscopy Journal
- Administrative Office Relocation
- Knee Consensus Meeting
- Upper Extremity Meeting
- Journal Advisory Task Force
- Campaign Update
- Traveling Fellowship Development
- Patellofemoral Foundation Fellowship
- 2005 Biennial ISAKOS Congress
- Infrastructure and Operations
- Regional Workshops and Symposia
- Committee Projects and Research Initiatives
- ISAKOS International Presidents Council (IIPC)
- Global Leadership Retreat

To implement the wishes of our members and of our donors we have formed the Strategic Advisory Task Force (SATF) under the leadership of Pete Fowler and myself. The SATF will prioritize the educational and scientific activities of ISAKOS based on campaign promises and projected revenue.

The goals of the Strategic Advisory Task Force (SATF) are *continued on page 9.*

International Symposium on Sports Medicine - Jerusalem, Israel
The Israel Society of Knee Surgery and Arthroscopy
The Israel Shoulder and Elbow Society
The Israel Orthopaedic Foot and Ankle Society
February 25-26 2004
For further information please contact: the Congress Chairman, Gideon Mann, MD
gmann@sportsmedicine.co.il
or fax + 972 2 534-1217
www.sportsmedicine.co.il

Advanced Course in Arthroscopic Surgery - Åre, Sweden
The Department of Orthopaedic Surgery
Huddinge University Hospital, Karolinska Institute
To be held at Hotel Tott, Åre, Sweden
March 17-21, 2004
Course Director: Professor Torsten Wredmark
For further information please contact:
Ann-charlott.nordstrom@cfss.ki.se
Fax +46 8 5858 2224

Update in ACL Surgery 2004 -Amsterdam, The Netherlands
Dutch Arthroscopy Association
(Nederlandse Vereniging voor Arthroscopie)
March 27, 2004
For further information, please contact:
Mr. Arthur Kleipool, MD
Fax: +31-20-5663998
a.e.b.kleipool@olvg.nl

4th Annual Midwest Arthroplasty Course - Minneapolis, MN USA
THE KNEE: Ligament & Arthritis
May 14-16, 2004
For further information, please contact:
Ms. Samantha McCready
Fax: +1-612-626-7766
mccre005@umn.edu

ARGENTINA 2004 - Buenos Aires, Argentina
Congress of Arthroscopy and Sports Medicine
May 21-25, 2004
www.artroscopia.com.ar
For further information, please contact:
Miss Laura Esposito
Fax: +54-11-4811-2389
Email: artroscopia_arg@ciudad.com.ar

Amsterdam Foot and Ankle Course - Amsterdam, The Netherlands
The University Hospital of Amsterdam (AMC)
May 27-28, 2004
For further information please contact:
Professor C.N. Van Dijk
Fax +31 20 566 2938
m.lammerts@amc.uva.nl and/or
l.beimers@amc.uva.nl

5th Symposium of the International Cartilage Repair Society (ICRS) - Gent, Belgium
International Congress Center
May 26-29, 2004
For further information please contact the ICRS Controller,
Alexander Konstantinidis, MD
Icrs2004@cartilage.org
Fax +41 1 390 1840

The 5th SMC Shoulder Symposium - Seoul, Korea
Independent Course
June 10-12, 2004
www.shoulderscope.com
For further information, please contact:
Seung-Ho Kim, MD
Fax: +82-2-3410-0061
Email: smcknot@hotmail.com or
smcknot@smc.samsung.co.kr

Advanced Arthroscopy Course on the Shoulder and Knee - Utrecht, The Netherlands
Anatomy Department of Utrecht University
June 22-24, 2004
Local Organizing Committee Chairman
Jaap Willems, MD
For further information: w.j.willems@xs4all.nl
Fax +31 20 599 3998

Superior Course of the Argentine Arthroscopy Association Continues Successful Series

Organized by the Argentine Arthroscopy Association, the 2nd Superior Course on Anterior and Posterior Cruciate Ligament and Posterolateral Complex was held at the Universidad Austral in Buenos Aires, Argentina, from September 5-6, 2003.

The course was sponsored by SLARD and was ISAKOS-Approved. It was one of a series of courses that are held on a regular basis on various topics. All courses feature a high degree of theoretical and hands-on training.

The recent Universidad Austral Hospital workshops allowed participants to practice surgical techniques on fresh frozen cadavers. Attendees from all over Latin America attested to strong interest in such intensive training activities; in courses of a high scientific quality that are taught in Spanish.

The next course will be held on May 19-20, as a preliminary course to the International Congress ARGENTINA 2004, to be held from May 21-25, 2004 in Buenos Aires. The course will consist of a cadaver laboratory, focusing on shoulder instability and rotator cuff injuries.
For further information, visit
www.artroscopia.com.ar.

Well-organized hands-on training workshops at the University Hospital allowed attendees to practice a variety of surgical techniques.

ISAKOS ADDS NEWSLETTER FEATURE

ISAKOS is beginning a new feature in its newsletter, called "What Are New Members Saying?" Every few months, ISAKOS will randomly select several new members, and ask them to answer one of several questions:

1. What role does ISAKOS play in your practice, community, region or nation? As ISAKOS grows, what future role would you like to see it play? How could ISAKOS be a better asset to you?

2. What do you see as being the greatest challenge(s) that ISAKOS faces? What is/are its greatest strength(s)?

3. Which past ISAKOS congress did you attend? What impressed you most about it? When you came home and told peers about it, what did you emphasize? What would you improve?

ISAKOS hopes that this new feature will serve several purposes:

1. Provide the ISAKOS membership with the opportunity to see/hear where an outside voice sees the organization heading;

2. Provide the new members with the opportunity to have their voices heard and offer some immediate involvement and;

3. Provide industry and non-members with the opportunity to see the worldwide impact and exposure of ISAKOS

ISAKOS welcomes all members' insights and opinions. If you have something to say, please email the ISAKOS office. We reserve the right to edit your letters for grammar.

WHAT ARE NEW MEMBERS SAYING?

"The last ISAKOS meeting that I attended was in New Zealand. I was very satisfied with all of the meeting: it had very good organization and interesting topics about arthroscopic surgery. New Zealand is a wonderful country. I was very satisfied with all of it!"
-New ISAKOS Member Dr. Antonio Ortega Basulto
Merida, Yucatan, Mexico

"ISAKOS is well-known in Lithuania. The first introduction was 6 years ago: ISAKOS approved basic and advanced arthroscopic surgery courses that were held by the French Arthroscopic Society. At this time, there are 6 Lithuanian ISAKOS members.

Because of ISAKOS, I can keep in touch with new technologies and communicate with the best surgeons of different subspecialties. The *Arthroscopy* journal and the newsletter are also invaluable sources of information.

With a growing ISAKOS I would like to see more collaboration between regional arthroscopic societies, more conjoined courses, and more information about participating in multi-center studies. The ISAKOS website provides information about teaching centers; exchange fellowships and scholarships would also help young surgeons to improve knowledge and skills, extend appliance of arthroscopic surgery and keep up to date with new techniques."
-New ISAKOS Member Dr. Viktoras Jermolajevas
Silute, Lithuania

Strategic Advisory Task Force & Executive Board *continued from page 7*

- To formulate a five-year strategic implementation plan recommending the allocation of funds and project logistics; submit plan to the ISAKOS executive board for adoption
- To direct the execution of these activities according to promises made to Global Connection donors, within the framework of ISAKOS' mission, bylaws and committee structure, and in concert with the ISAKOS administrative staff and boards

SPOTLIGHT ON TEACHING CENTERS

Gabinete C.O.T. Clinica del Pilar, Barcelona, Spain

Staff Members

Director: Ramon Cugat, MD

Orthopaedic Surgeons: Pedro Alvarez, Ramon Cugat, Xavier Cusco, Montse García, Xavier Juan, Juan Carlos Monllau, Roberto Seijas, Jaume Vilaro

Sports Medicine: Ramon Balius, Alex Godall, Natalia Llorens, Edu Mauri, Angel Ruiz-Cotorro

General and Sports Therapists: M. Angeles Enguita, Ivan Navas, Miguel Angel Perez, Emile Ricart

Overview

This group of doctors, headed by Ramon Cugat, MD, and based at the Clínica del Pilar, Barcelona, (an ISAKOS-Approved Teaching Center), works in the Catalan Football Federation. It is responsible for the care of more than 100,000 soccer players, as well as thousands of athletes from other sports, such as tennis and American Football. Of this population, between 15,000 and 16,000 lesions are treated per season. As well as these athletes, the group also treats members of medical insurance companies.

Dr. Cugat began working in 1975. Today, the group consists of orthopaedic surgeons, sports medicine doctors and general and sports therapists.

Centre Activities

The center's principal activities include visits and control of out-patients, as well as surgery, of which the great majority is arthroscopy and orthopaedic sports surgery. Some general orthopaedic surgery is also carried out at the centre.

Most work consists of the following:

Visit and control of out-patients
Surgery
95% arthroscopy and orthopaedic sports surgery
5% General orthopaedic surgery
Physiotherapy and rehabilitation
Readaptation to sporting activity
Preventive sports medicine

Types of Patients

Athletes and non-athletes are treated at the centre. Of the athletes who are treated, the population includes soccer players, tennis players, American football players and others.

Research

Research is carried out at the Anatomy & Human Embryology Department of the Medical School of Barcelona University, whose chairman is Professor Dr. Domingo Ruano Gil.

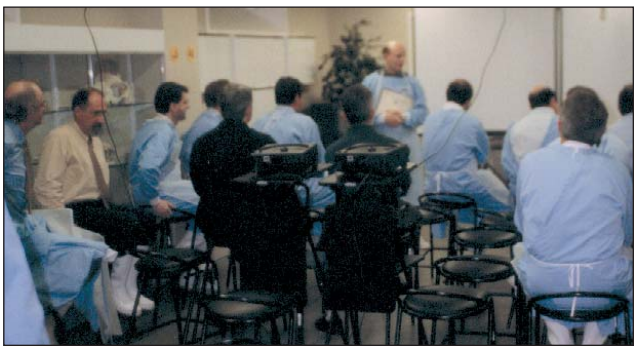
Background

Toward the end of the 1980´s, Prof. Ruano Gil agreed to a proposal to teach arthroscopic anatomy, as proposed by Ramon Cugat, Joaquin Cabot, Montse García and Miquel Llobet.

Sponsors

Smith and Nephew has provided full support from the beginning of the project, and currently other commercial companies, such as Arthrex, Linvatec, etc., also contribute when courses are held.

Approximately four courses are held annually, given by arthroscopy surgeons and anatomical physicians. These courses have been sponsored by the AEA (Spanish Arthroscopy Association).



As the Barcelona University Anatomy & Human Embryology Department is open to students and researchers, each year it welcomes groups of professionals from foreign countries, such as Italy, Netherlands, etc.

Educational Opportunities

The Gabinete C.O.T. Clinica del Pilar allows the studies of any open/arthroscopic surgery with prior reservation. In addition, the clinic organizes several annual courses on basic and advanced arthroscopic techniques.

Because the clinic has nine physicians on its staff, visiting students can work any day of the week, either in the surgery room or visiting patients. The following program, however, is recommended:

Monday, Wednesday morning and Thursday – Visit outpatients or, with prior arrangements, attend the anatomy lab

Tuesday, Wednesday afternoon and Friday – Surgery

This program is the standard that is recommended; however, every fellow is interviewed upon their arrival, and a personal program is tailored to the fellow's needs.

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The Journal Arthroscopy: A History

Gary G. Poehling, MD, Editor-in-Chief

Editor's Note: As ISAKOS and the Journal Board of Trustees renew another contract for partnership, we asked Gary G. Poehling, ISAKOS Past President and current Journal Editor-in-Chief, to write about the history of this important publication and its direction for the future.

The Journal of Arthroscopy was conceived and developed in 1984. The first editor was Dr. Ward Casscells from Wilmington, Delaware. The first year of publication was 1985 with four issues published per year. By the end of the first year, there was some concern that we may not have enough material to print. I remember the editorial board meeting, of which I was a member, when Dr. Cascells invited each of us to write an article because he was sure that nothing more would be coming in! Since that time there has been a rapid growth of article submissions.

In 1987 I was appointed as Associate Editor for the Journal by Dr. Jack McGinty. He noted that the majority of the articles were from the United States, and said it would be good if I focused my attention on international submissions. Currently, 60% of journal submissions are non-North American.

In 1989 I was appointed Editor-in-Chief of the Journal. Anne Skulskie joined me as Managing Editor in 1991. We began with three associates editors, but over the years we have added an additional three because of the increase in submissions. These editors are chosen from our best reviewers and are appointed for a 5-year period. We see the journal as an evolving entity and are constantly striving to improve its quality. With the associate editors, we developed the Journal Review Course which has added to the quality of our reviews, and consequently to our published articles.

We presently publish ten issues per year and plan to go to twelve issues within the next one to two years. The number of submissions has grown from eighteen in our first year to well over 500 presently. The peer review process is highly structured and involves people from all over the world. Reviewers have been extremely generous in giving their time and expertise to improve our journal and to give benefit to our readership. Hopefully, this review process will be expedited as we move to online submissions and reviewing in early 2004. I would invite anyone who is interested in being a part of the continued growth of the Journal to contact us and become a reviewer. It truly gives one a sense of accomplishment to know that you are helping others bring their ideas to the world.

The content of the Journal has expanded from pure arthroscopy in 1985 to a broad range of topics including knee surgery and orthopedic sports medicine. We also include minimally-invasive surgery. We are embarking on our 20th year as a publication. While we have come a long way, we continually strive to improve our ability to communicate in a scientifically accurate way that will benefit each of us and, more importantly, offer state-of-the-art care to our patients.

MEXICO WELCOMES ISAKOS

Moises Cohen, MD, 2003-2005 ISAKOS *Assistant Secretary*

The XVII *Mexican Orthopaedics and Traumatology Congress* of the Mexican Association of Orthopaedics and Traumatology (AMOT) was held from November 19 -23, 2003, in Cancun, Mexico.

On the afternoon of November 19, Dr. Maria Castellanos, AMOT President, dedicated the scientific session to the Latin American Society of Orthopaedics and Traumatology (SLARD), which was then presided over by Dr. Eduardo Zamudio, SLARD President. Approximately 1,000 people attended the SLARD afternoon session. During that time, 10 minutes were allocated to the promotion of ISAKOS. Graphs illustrated the growth of ISAKOS, especially in the Latin countries, and the advantages of ISAKOS membership were extolled. All audience members received folders containing ISAKOS membership applications, as well as 2005 Congress information.

On November 20, several key SLARD/ISAKOS members, including Dr. Moises Cohen and Dr. Eduardo Zamudio, attended a board meeting with the directors of the Mexican Association of Knee and Joint Surgery (AMECRA). AMECRA boasts 900 members and has just been incorporated with SLARD. The SLARD/ISAKOS members explained the advantages of ISAKOS membership for AMECRA members, and it was agreed that ISAKOS would now encourage AMECRA members to apply for "immediate" Associate membership through their new status as SLARD members. The SLARD/ISAKOS members also encouraged AMECRA members to submit as many abstracts as possible to the next ISAKOS Congress in Hollywood.

In a final gesture, ISAKOS President Per Renstrom sent a welcome letter to the AMECRA members, which was handed to its president, Dr. Arturo Gutierrez Menezes.

Throughout the entire AMOT Congress, a tremendous amount of respect and kindness was shown to the ISAKOS ambassadors. There is a great potential for growth and exchange between the organizations.

From left to right: *David Bernal*, AMECRA *1st Vice-President*; *Moises Cohen*, ISAKOS *Assistant Secretary*; *Arturo Meneses*, AMECRA *President*; *Mario Castellanos*, AMOT *President*; *Carlos Alvarado*, SLARD *Directory (Peru)*; *Eduardo Zamudio*, SLARD *President*; *Juan Cisneros*, AMECRA *2nd Vice-President*

Global Connection *continued from page 3*

- An invitation to join us for an exclusive ***Global Connection*** Donor Cocktail Reception during the March 2004 AAOS meeting (Just a few weeks away!)
- A ***Global Connection*** pin and Certificate of Appreciation
- On-stage recognition at the Campaign Celebration to be held during the 2005 ISAKOS Biennial Congress in Hollywood, Florida

Member Donors

Our members throughout the world are the key to ISAKOS' growing success. Special thanks go to the following individuals for their generous support of the ***Global Connection: Expanding International Education*** campaign!

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The First Brazilian Autologous Chondrocyte Transplantation

Moises Cohen, MD, PhD, *Brazil*

In March 2003, Dr. Moisés Cohen made the first Brazilian autologous chondrocyte transplantation. Cohen, a post-PhD professor in orthopedics and traumatology at the Federal University of São Paulo Paulista Medical School, was inspired by the results of the technique as he saw them presented at scientific meetings and in publications. The Brazilian transplantation culminated years of intense research to adapt and implement the technology in Brazil and South America.

The idea of autologous chondrocyte transplantation was first received with some reluctance in Brazil, as the study of cell therapy applications was just beginning there. In order to make the idea viable, Cohen coordinated a "Brazilian Cartilage Study Group". An executive of the Brazilian orthopedics industry supported the group: Eng. Geraldo Marins dos Reis Jr. was interested in the research and development of biological products. Qualified profes-sionals were then carefully chosen to participate in the group: Dra Christiane Bertachini Lombello, a PhD in cell biology, specializing in chondrocyte culture; Luciana Leão Perin, a biologist with experience in quality control; and Camila Cohen, a medical student who had worked with cell culture technique at Pittsburgh University with John Huard under the coordination of Freddie Fu, MD.

During the year of 2000, the group had two main tasks: collect all information from the literature and improve conditions to establish this technique in Brazil. Group meetings were sparse and their research was intense. Lack of Brazilian experience made the work more difficult; much of the information was collected from the pharmaceutical and orthopedic industries. The participation of group members in international meetings and courses was extremely important in orientating efforts.

In 2001, Reis invested in the construction of the first Brazilian cell culture laboratory. The laboratory specialized in chondrocyte culture for autologous transplantation. It was named Biologica.

During this period, the meetings of the Brazilian Cartilage Study Group were extremely important. The group needed to establish its requirements for the laboratory. The group focused on laboratory quality control in order to guarantee culture conditions and adapt a culture protocol. The meetings became lessons in cartilage biology, chondral lesions, cell metabolism, surgical techniques, etc.

The investment soon evolved into a modern cell culture laboratory, ready to initiate activities.

January 2002, first tests were made. All procedures were tested. The research group began to focus on direct application. The ideal conditions of extracting the biopsy and transport conditions were established, including an ultraestructural research of biopsies at 0, 6, 24 and 48 hours after the surgery. The work resulted in a poster presentation at the 4th ICRS Meeting in Toronto, Canada, 2002.

Continued group meetings made the work easier for everyone. All encountered difficulties were described and alternatives were discussed, resulting in optimized efforts.

The next phase, however, separated the laboratory specialists from the doctors. The laboratory specialists first examined all culture steps and conditions, looking for the best application of the technique in Brazil based on literature descriptions. The doctors examined all information pertaining to surgical technique and rehabilitation processes. The year 2002 was spent in basic research, laboratory improvement and documentation for the first Brazilian autologous chondrocyte transplantation.

After three years of careful and detailed work, Cohen performed the first Brazilian autologous chondrocyte transplantation in March 2003. Its success clearly demonstrates how important teamwork is in the ongoing search for improvement in patient care.

On A Personal Note

Per A.Renström, MD, PhD
ISAKOS *President*
2003-2005

On a personal level, I would like to inform you that I had a heart incident in July 2003. In spite of being in good health and having no known risk factors besides hard work, I developed heart problems this past summer. An angiogram showed some occlusions in my coronary vessels, some of which were located proximally. This resulted in a subacute surgery in July. The heart was fine but the surgeons first had to remove a very thickened pericardium secondary to an old chronic pericarditis. They performed by-pass surgery of the coronary vessels, using a couple of chest arteries. I have now returned to work and am very grateful all has gone well. This event has given me lots of time for reflection of what life is about and what is important. I would like to take this opportunity to thank you for all the warm greetings of a full and speedy recovery that I had received during this time.

Indian Arthroscopy Society Updates Web Site

The Indian Arthroscopy Society announces a new, improved Web site that offers information for members and nonmembers.
Visit www.indianarthroscopy.org
for more information.

REPAIR OF DISTAL BICEPS TENDON AVULSION WITH THE ENDOBUTTON: A Minimally Invasive Technique

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Due to the development of heterotopic bone formation and technical simplicity, single anterior incision techniques have again become popular. With a minimally invasive technique via a 5 cm transverse skin incision, the tendon is sutured to the Endobutton with two number 5 Ethibond Bunnell sutures. There is no need to perform surgical repair in the depths of the bulky forearm because the tendon is simply sutured external to the wound. This "prefabricated" Endobutton/tendon unit is then locked into drill holes in the proximal radius. This construct is strong enough to allow early and active mobilization. It can also be used for partial tendon ruptures. An autologous hamstring tendon graft is used to lengthen the tendon in patients with a delayed presentation.

Introduction

The majority of authors would recommend a surgical repair of avulsion of the distal biceps tendon because conservative management leads to deficiency of strength and endurance of forearm supination and elbow flexion.[1-3]

Initially anterior surgical approaches were used but came into disrepute because of injury to the radial nerve and posterior interosseous nerve.[4-8] Because of the risk of nerve injury, Boyd and Anderson in 1961 developed a double incision technique with fixation of the tendon over a bony trough in the radial tuberosity.[4] The incidence of radioulnar synostosis and the need for two incisions has led some authors to advocate fixation with suture anchors using a single anterior approach.[9,10]

However, tying sutures onto a suture anchor in the bulky forearm depths of a patient with a biceps tendon avulsion is technically difficult. The tendon needs to be advanced down onto the radial tuberosity, with the elbow flexed, without compromising adjacent neurovascular structures.

The Endobutton (Acuflex, Microsurgical Inc., Mansfield, MA) was developed for fixation of the anterior cruciate ligament graft. It provides strong fixation which allows early active mobilisation in the knee. Development of this technique to allow early active mobilisation for biceps tendon was first performed by the author in 1995. The first twelve patients were subsequently reviewed and the clinical results and a cadaveric study published in the Journal of Shoulder and Elbow Surgery 2000.[11]

The patient often presents with a history of attempting a forced flexion and/or forearm supination against a considerable resisting force. The patient will often have bruising on the medial side of the elbow, pain and swelling. The biceps muscle will have an unusual contour, with the bulk of the muscle translated proximally. The normal biceps tendon is not palpable in the cubital fossa when attempting to flex the elbow against resistance. The power of supination against resistance is considerably reduced compared with the opposite side.

Non-operative treatment is likely to leave the patient with a dull ache in the arm, particularly when performing sustained activities.[12] Patients have a persistent marked decrease in forearm supination strength, as the biceps tendon is the prime supinator of the forearm. Loss of elbow flexion power is not so severe as it is supported by other muscles, such as brachialis, brachioradialis and pronator teres. However, it is the patient's endurance when performing repetitive activities that is most profound.[13] The patient who requires repetitive use of the upper limb (particularly in the dominant arm) is likely to be severely disabled with an untreated distal biceps tendon avulsion.

The author routinely performs a set of plain radiographs of the elbow pre-operatively. Occasionally a small flake of bone will be avulsed with the tendon. For the patient who presents with obvious biceps tendon avulsion with the proximal migration of the muscle belly, no other pre-operative investigations are required. The author has witnessed many patients with complete avulsion in which ultrasound and magnetic resonance imaging have been misinterpreted as partial tears or normal tendons surrounded by haematoma.

The patient who presents with a true partial tear, in which case the biceps tendon and muscle are not proximally migrated, is difficult to assess. A high index of clinical suspicion is required, and an understanding of the mechanism of injury is the key to ensure that this problem is identified from the history of injury. The patient may have localised tenderness over the tendon and weakness with elbow flexion and forearm supination against resistance. Formal dynamic isometric muscle testing can be performed to document the level of weakness. In this complex group of patients the author has used ultrasound and MRI scanning to assess the biceps tendon insertion. However, in the acute and chronic situation the diagnosis is difficult to confirm using these imaging modalities.

Technique

Set-up

The patient is given a general anaesthetic, the arm is exsanguinated and tourniquet inflated. The arm is placed onto an arm table with the elbow extended.

Approach

A 5 cm transverse incision is made 2 cm distal to the elbow skin crease. The lateral cutaneous nerve of the forearm is identified and taped. The deep fascia is incised and an inflammatory bursa filled with haemo-serous fluid is identified in the space previously occupied by the avulsed biceps tendon. The surgeon can usually easily identify the tendon, which is retracted proximally, and deliver it into the wound. By placing the elbow into full extension and supination, the radial tuberosity is exposed with the aid of a hand-held right angle retractor. These retractors are preferred to levers to minimise the chance of injury to the adjacent neurovascular structures. The neurovascular structures are not formally explored in the acute case, as the surgeon can simply operate

through the tract previously occupied by the tendon.

Preparation of the Radius

A cortical window large enough to accommodate the biceps tendon is made with the aid of a high speed burr. The surgeon must stay as medial as possible, with the arm held at maximal supination so that it reproduces the normal anatomical position of the biceps insertion into the radial tuberosity. A 4.5 mm drill with a guard is then introduced through the anterior-medial cortical window in the proximal radius. This is drilled through the posterior cortex, ensuring that an adequate bridge of bone between the window and drill hole is maintained.

Fixation of Endobutton to Tendon

The biceps tendon is then delivered external to the wound and the necrotic tendon end is debrided. Two number 5 Ethibond (Ethicon Inc., Sommerville, NJ) sutures are used to secure the tendon to the two central holes of the Endobutton. Bunnell sutures are placed along the medial and lateral aspects of the tendon, preserving the middle section to maintain vascularity. The Bunnell suture is commenced proximally and advanced distally through the holes of the Endobutton before returning proximally to be tied. A gap of 2 mm is left between the Endobutton and the tendon end to allow the Endobutton to be manipulated across the cortex of the radius. The sutures are tied proximally so that they are away from the Endobutton and do not interfere with it locking into the radius.

An extra suture is placed into each of the two outer holes of the Endobutton. These are used to manipulate the Endobutton across the radius. Sutures of different colour are chosen (eg Ethibond and Prolene) so that the surgeon is orientated as to which suture is controlling which end of the Endobutton. These are referred to as leading and trailing sutures.

At this point the Endobutton/tendon unit is "prefabricated", ready for fixation to the radius (Fig. 1,2). All the suturing and preparation of the radius has been performed, with the tendon delivered from the wound and with the elbow extended. This is fundamentally different to suture anchors that provide fixation by tying the sutures

Figure 1

Figure 2

down onto the radius in a bulky forearm with the elbow flexed.

The wound is irrigated to minimize the chance of heterotopic bone formation. A Beath straight-eyed needle is then advanced through the cortical window and out through the dorsal aspect of the proximal forearm. This needle delivers the two sutures which control and allow manipulation of the Endobutton. It is important that this needle be advanced directly posterior (Fig. 3a). A cadaveric cross-sectional anatomical study has demonstrated that there is a safe zone between 0º and 30?. If the pin is advanced out as far as 45? it is possible that a posterior interosseous nerve injury will occur (Fig. 3b).[11]

The elbow is only then flexed and fully supinated. Care is taken to ensure that the tendon is appropriately aligned. Traction is then placed on the leading and trailing sutures to deliver the Endobutton to the dorsal aspect of the proximal radius (Fig. 3c).

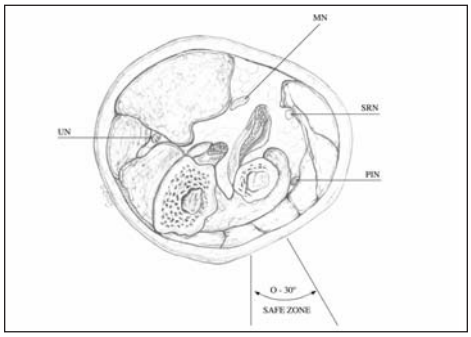

Figure 3a

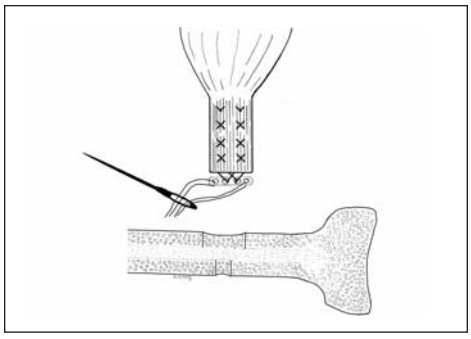

Figure 3b

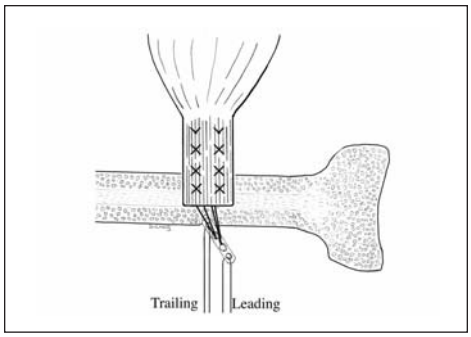

Figure 3c

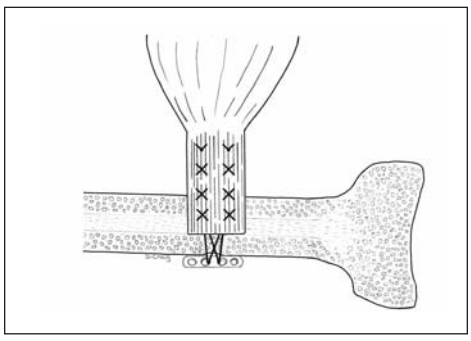

Figure 3d

By placing tension onto the trailing suture, the Endobutton locks into position and prevents proximal migration of the tendon (Fig. 3d). Fluoroscopy is useful to assess the position of the Endobutton as it is advanced through the radius and locked into position.[14] The leading and trailing sutures are simply removed. The elbow is taken through a full range of motion to ensure that the tendon is secure.

Results

The author has published the results of his first twelve cases at an average follow-up of 17 months.[11] All patients were satisfied with their outcome and were able to return to activities of daily living. No neurovascular complications occurred. There was no clinical or radiological evidence of radioulnar synostosis in any patient. All patients had an intact biceps tendon and had a return of grade 5 power. The average range of flexion was from 5? to 146?. The average supination was 81? and average pronation 80?. The only complication in the series was a patient who developed an abscess six months after the surgery which resolved with incision, drainage and antibiotics.

Complications

To our knowledge, re-rupture has not occurred with any of the 40 cases using the Endobutton technique performed by the author.

A cadaveric study assessing the safety of this technique has been performed (Fig. 3b).[11] On the anterior aspect of the elbow the structure most at risk is the ulnar artery, which on average is 6 mm from the biceps tendon. The distance from a Beath pin to the posterior interosseous nerve is quite variable. If the Beath pin is advanced in a posterolateral direction at 45? then injury to the posterior interosseous nerve can occur. It is important when advancing the pin that it is advanced directly posterior to minimize the chance of this complication. The use of hand-held right angle retractors are much less likely to cause anterior neurovascular structure injury than various levers. The author is concerned that the use of Hohmann retractors may lead to injury to anterior neurovascular structures.

There is the potential to sustain a proximal radius fracture. It is important that the bony bridge between the anterior cortical window and posterior drill hole is adequate to minimise the risk of fracture. Irrigation of the wound and the minimally invasive technique reduce the risk of heterotopic ossification. The author has witnessed heterotopic bone with this technique but this is usually minimal and does not affect function.

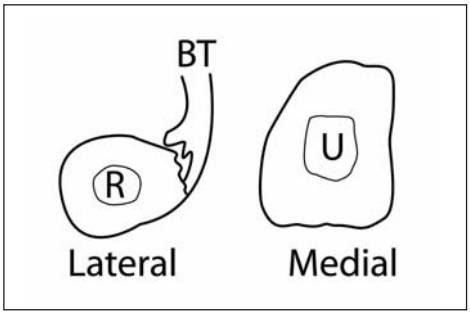

Figure 4

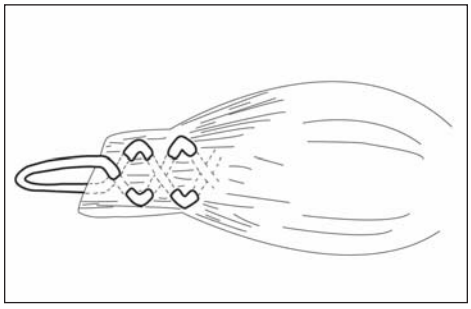

Figure 5

Post-operative Management

The author has managed his patients with a plaster back-slab, with the elbow at 90? of flexion and the forearm in full supination for the first week after surgery. The back-slab is then removed and the patient provided with a sling, with advice that it can be removed and the elbow mobilised as tolerated. The patient is advised not to perform any heavy lifting or grasping for a period of three months and not to perform any maximal flexion or supination of the forearm for a period of six months. We have not used anti-inflammatory medications or physiotherapy.

The surgical management of the patient with a delayed tendon rupture is much more difficult than that of an acute repair. A complete open Henry's approach is required to ensure that neurovascular safety is maintained throughout the procedure. The biceps tendon will be adherent to the adjacent muscle and will be difficult to deliver. It can be seen that the biceps tendon concertinas and shortens. Even with traction it is usually impossible to re-establish its normal anatomical length. It is interesting that if the bicipital aponeurosis is intact the aponeurosis will maintain its normal length, as will the tendon proximal to the aponeurosis. Morrey has recommended an Achilles' tendon autograft or synthetic ligament augmentation devise (LAD).[3] The author prefers a medial hamstring tendon, which is harvested with the aid of a tendon stripper. The tendon is then interwoven into the native biceps tendon. The Endobutton is attached to the distal aspect of the tendon graft using the technique described for the acute avulsion. It is also important to consider that the lacertus fibrosis/biceps tendon unit spans the ulna and radius and contains the median nerve and brachial artery. If biceps tendon is too tight, then the neurovascular structures will be strangled in pronation as the biceps wraps around the radius.

Discussion

The surgical exposure used in this technique is minimally invasive as it requires only a small anterior incision, which takes the surgeon to the deep fascia where the biceps tendon is located. This anterior approach is also being used by other authors for other fixation techniques.15 In acute cases the tendon can usually be identified and mobilised. However, after four to six weeks the tendon will be adherent to the adjacent muscle, and much greater exposure is required to be able to perform this safely.

The concept of pre-fabrication is where the tendon is delivered from the wound and the sutures are then used to fix the Endobutton to the tendon. The extra sutures are added to the Endobutton to allow it to be manipulated. At this point the construct is prefabricated such that by advancing the sutures across the radius, the Endobutton can then be used to deliver and lock the tendon into position.

The repair technique is strong and was the first technique where active mobilisation following a biceps tendon repair was recommended. This is due to the fact that two strong number 5 Ethibond sutures can be used to secure the robust Endobutton. The tendon, once secured, is positioned within the intramedullary canal which maximises the surface area between the tendon and the radial tuberosity.

A comparison with the Endobutton and suture anchors is made in Table 1. The suture anchor usually utilises a smaller number 2 suture and, in a male patient with a big bulky forearm requires the surgeon to advance the knot and tendon down onto the radial tuberosity. If the surgeon is successful in advancing the tendon then it relies on healing onto the cortical surface with a relatively minimal contact area. If there is any gapping at the suture anchor due to inability to tighten the suture, there will be a gap between the tendon and the cortical surface.

The two-incision technique described by Boyd and Anderson requires the use of two incisions and has the risk of heterotopic bone formation.[4] The strength of fixation is reduced as it requires sutures to be secured over a bone bridge, and for this reason early active mobilisation has not been recommended.

The Endobutton technique is relatively simple. We have found the use of fluoroscopy to be useful in identifying the exact position of the Endobutton at the time of advancing it across the radius.

Further details with regard to this technique can be obtained from www.gregbain.com.au

Acknowledgment:

Ron Heptinstall for his assistance with preparation of manuscript

Deidre Craig for the art work provided in this manuscript

Figure Legend

1. The Endobutton compared to suture anchor.
2. A biceps tendon is delivered through an incision and two Bunnell 5 Ethibond sutures fix the Endobutton. With leading and trailing sutures attached, the tendon is "prefabricated" ready for fixation. (Used with permission from the Journal of Shoulder and Elbow Surgery)

3a. Straight-eyed needle with leading and trailing sutures attached. (Used with permission from the Journal of Shoulder and Elbow Surgery)

3b. Cross-sectional anatomy of the forearm at the level of radial tuberosity with relationship of major nerves, UN, ulnar nerve; MN, median nerve (just proximal to pronator teres muscle); PIN, post interosseous nerve (anteriorly at the Arcade of Frohes); SBRN, superficial branch of radial nerve. (Used with permission from the Journal of Shoulder and Elbow Surgery)

3c. Traction is placed onto the leading and trailing sutures which advance the Endobutton and the tendon into the wound. (Used with permission from the Journal of Shoulder and Elbow Surgery)

3d. Endobutton locks on the dorsal aspect of the radius and holds the tendon within the intramedullary canal of the proximal radius. The leading and trailing sutures are removed. (Used with permission from the Journal of Shoulder and Elbow Surgery)

4. Partition tendon rupture with the superficial fibres intact and the deep fibres avulsed.
5. Delayed tendon reconstruction using the medial hamstring tendon graft, which is interwoven into the native biceps tendon.

Table 1

	Endobutton	Suture anchor	Bone trough
Incisons	1	1	2
Suture Technique	Prefabrication	Suture in depth of wound	Suture in 2nd incision
Suture	2x No. 5	1 (2) No. 2	2x No. 2 (5)
Interface	Medullary	Surface	Trough
Strength	+++	+	+
Mobility	Active	Delayed	Delayed

REFERENCES

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BICRUCIATE LESIONS

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Bicruciate lesions are rare but serious. There is no internationally accepted management plan.

In the published series, either the number of cases was limited or the follow-up was not long enough. In retrospective multi-center series, management is not homogenous. To propose a multicentric study will not solve the problem. We need to clearly identity the questions that must be answered.

In the discussion of bicruciate lesions, problems arise concerning the terminology, definition, and classification. The classical terminology "multiple ligament injury" is very confusing. It doesn't mean that the central pivot (ACL and PCL) is torn. In Europe, several authors, following Albert Trillat, differentiate between pentade and dislocation. In pentade either the medial or lateral ligamentous structures are preserved, and complications are less frequent than in dislocation. Most reports in the literature of complete dislocations are with respect to lesions of either the ACL or PCL. It is important to differentiate two types of peripheral lesions, those resulting from an opening forces which produces rupture of ligaments and those following an osteoperiosteal detachment (or stripping in the manner of a peeled banana) that demonstrate little true ligamentous ruptures. However in these cases of osteoperiosteal stripping, there may be detachment of the capsule, which can start at the level of the epiphysis and extend to the metaphysis.

It is crucial to recognise every elementary ligamentous lesion. The difficulty is not only to make the diagnosis of dislocation that is obvious when the knee is dislocated (the position of the tibia reveals the direction of the dislocation), but also to make the diagnosis after spontaneous reduction. After reduction, movement of the joint can be remarkably free of pain. There will always be considerable instability, which on occasion may allow movement in all directions (a true "flail knee"). Anteroposterior, lateral and axial radiographs are required. A lateral view taken at 20° flexion with the patient lying supine when compared to a film of the contralateral knee taken in the same position may reveal posterior translation. In severe knee injuries dynamic radiographs are essential. They can be taken either with the patient awake, under anaesthesia at the time of reduction or at the start of an operation. It is necessary to perform radiographs with the knee stressed in varus and valgus, as well as with the tibia moved inferiorly and posteriorly. Additional stress views may include medial and lateral translation of the tibia in relation to the femur. Care must be taken not to redislocate the joint. These examinations can help to distinguish between opening lesions and capsular periosteal detachments. Information gained from a MRI taken soon after injury can influence the treatment plan. The site of the rupture of an anterior cruciate ligament will be revealed. MRI is even a greater value with lesions of the posterior cruciate ligament. A MRI can also demonstrate damage of the extensor apparatus, the peripheral capsular ligamentous structures, the menisci, as well as relatively minor osteochondral fractures.

Arthroscopy may be dangerous because of extravasation of fluid from the knee, which can result in a compartment syndrome. However, some surgeons to assess posterolateral lesions use a limited arthroscopic examination.

If we wish to establish a classification, compare results of ligamentous management and make recommendations, identification of every ligamentous lesions is the keystone. However, the management plan (still being debated) of bicruciate lesions will depend not only on the ligamentous damage but also on the real or potential complications. Bicruciate lesions of the knee are over shadowed by the importance of vascular complications. Since arterial lesions are frequent (15%-32% in literature) and are often difficult to diagnose, arteriography with or without MRI is strongly recommended.

The others complications that may influence the management plan include:

- Irreducibility
- Cutaneous complications
- Osseous and osteochondral lesions
- Lesions of the extensor apparatus
- Neurologtical complications
- Veinous complications.

Of course, it is also very important to consider the age and the motivation of the patient. We have several options for management of peripheral ligamentous lesions, non-operative (plaster, external fixation, and patellar tibial fixation) or operative: suture +/+- augmentation, reconstruction, and fixation of bone block. In the selection of a management plan, it is important to consider separately ligamentous lesions produced by opening and those produced by stripping. With stripping and reduction, there is no complete rupture allowing the return of good stability. A different situation occurs with lesions resulting from opening. Every time that a ligament is avulsed with a fragment of bone, this fragment must be replaced and fixed in its original position. If the rupture is in the body of the ligament, an attempt must be made to repair the fibres, which have been torn. When the collateral ligament (particularly the lateral collateral ligament) has been completely torn apart, a graft will be required for replacement.

When there are bicruciate lesions, priority is given to reconstruction of the posterior cruciate ligament. Reconstruction of the anterior cruciate does not take priority when there is also a torn posterior ligament, as simultaneous reconstruction of both ligaments increases the risk of fixing the knee with the tibia in a posteriorly subluxated position. Therefore, there are two options: 1) reconstruction of both ligaments at the earliest possible time or 2) initial reconstruction of only the posterior ligament, with a delayed reconstruction of the anterior cruciate ligament in the future. Some recommendations concerning the timing of reconstruction were established in 1998 during the ESSKA symposium.

1. As soon as possible reduce the dislocation and treat the arterial complications and open wounds.

2. Between the first and twenty first days, ligament surgery can be undertaken: however this should be done earlier if there is an articular fracture or rupture of the extensor apparatus. If an operation is done too early the tissues

are very oedematous and difficult to dissect.
3. Non-operative treatment can be considered in an elderly patient or a patient who has low demands for his knee. However, it is important not to leave interposed soft tissues and to obtain a perfect anatomical reduction of the knee.

These lesions are rare, severe and there management controversial. What a wonderful subject for an ISAKOS conference in the future: How to safely manage Bicruciate lesions.

REFERENCES

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A SHORT BASIC SCIENCES REVIEW OF ARTICULAR CARTILAGE

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Articular cartilage is a specialized connective tissue covering joint surfaces that enables efficient function of the joints by reducing friction and allowing load distribution. Macroscopically, it has a glistening, white appearance. Microscopically, it is composed of water, collagen, proteoglycans, chondrocytes and other matrix proteins and lipids. It is avascular and alymphatic. It was also thought to be aneural, though recent evidence suggests otherwise. The mechanisms of genetic regulation and degeneration of articular cartilage are important to our understanding the evolution of many degenerative and traumatic diseases.

Articular cartilage has been subdivided into five zones depending on the alignment of collagen fibers, which give each zone particular biomechanical advantages:

1. Superficial zone - resistant to shear
2. Transitional (middle) zone - resistant to compression
3. Radial (deep) zone - resistant to compression
4. Tidemark - resistant to shear
5. Calcified zone - acts as an anchor between articular cartilage and subchondral bone

Chondrocytes

Chondrocytes are highly specialized mesenchymal cells, contributing 5% to the whole weight and 1% to the volume of the articular cartilage. They are responsible for the production of the structural components of articular cartilage including collagen, proteoglycans and various enzymes. They are located in lacunae, usually scattered individually throughout articular cartilage. In arthritic cartilage, chondrocytes are recovered in clusters of up to thirty cells, which probably represents an attempt at tissue regeneration. During growth of the articular cartilage, chondrocytes have a constant, usually roundish shape, but their shape becomes more variable depending on age, pathological state and the cartilaginous layer to which they correspond. In the superficial zone they are streamlined and orientated parallel to the articular surface. In the intermediate zone they are spherical with a high metabolic activity. In the deep zone the cells are large with small nuclei and are arranged in perpendicular columns. Below in the zone of calcified cartilage they appear as small, roundish cells with a large nucleus. The modification of chondrocyte shape under load has been described and quantified using laser microscopes.

The morphology of chondrocytes varies with changes in osmotic pressure. In hypoosmotic conditions (120-150 mOsm), the plasma membrane swells until eventually lysis occurs. In hyperosmotic conditions (420mOsm), the cellular volume diminishes so the cell collapses on itself. In physiological conditions (300-350 mOsm), the plasma membrane has microvilli, which can be seen at electron microscopy, with a linear relationship between the cellular volume and the osmolality.

Chondrocytes are anaerobic, and receive their nutrition via diffusion of substances within synovial fluid, facilitated by movement of this fluid during movement of the joint.

Intercellular matrix

The intercellular matrix is composed of tissue fluid and structural macromolecules, including collagens, proteoglycans, noncollagenic proteins and glycoproteins. The relationship between these components determines the characteristic biomechanical properties of articular cartilage.

It has a high water content of approximately 80%, which is distributed nonuniformly (80% at the surface and 65% at the deep zone) to allow deformation of the cartilage under stress. Higher water content is found in the articular cartilage of patients with osteoarthritis, resulting in an increase in permeability, decreased strength and fibrillation.

The collagens present in articular cartilage include types II, VI, IX, X, XI, of which type II

Continued on next page

collagen represents 90-95%. Collagens consist of a triple helix of ? chains twisted to form a superhelix. These align in parallel rows with a quarter-staggered pattern; cross-linking of these molecules also occurs. Collagen provides a structural framework that determines the high tensile strength of cartilage. In the superficial zone fibrils are oriented tangentially, in the intermediate zone fibrils are orientated obliquely, and in the deep zone the fibrils are vertical. The function of type VI collagen is still uncertain, though it may well stabilize chondrocytes within the matrix. It is found in only small quantities in normal cartilage but is greatly increased in osteoarthritis. Type X collagen is found in hypertrophic cartilage, as seen in physes, fracture callus, or heterotopic ossification.

Proteoglycans provide the compressive strength to the articular cartilage and are composed of aggrecan molecules linked to hyaluronic acid to form an aggregate macromolecule. Aggrecan molecules are composed of a protein core with multiple glycosaminoglycans subunits. The glycosaminoglycans include chondroitin-4-sulphate, chonroitin-6-sulphate and keratin sulphate. In ageing, the level of chondroitin-4-sulphate decreases and that of keratin sulphate increases. Non-collagenic proteins including anchorin C II, fibronectin and chonronectin stabilize these proteoglycan macromolecules.

Regulation of articular cartilage synthesis

Local factors are necessary for intercellular communications, and they include cytokines and growth factors. A cytokine can be defined as a soluble low molecular weight cell product that affects the activity of other local cells in a paracrine manner. They may work on their cells of origin by an autocrine mechanism, or, when released into the circulation, may affect cells at a distant site, behaving as classic endocrine agents. In the bone and cartilage another mechanism of control exists, where locally produced growth factors, or those in the circulation, are incorporated into a mineralized matrix and are released during matrix dissolution by osteoclasts or chondroclasts. There is increasing evidence that abnormal production of cytokines in diseases such as rheumatoid arthritis, osteoarthritis and osteoporosis may result in inappropriate responses by bone and cartilage cells. Many articular cartilage growth factors have been identified:

- Insulin-like growth factors (IGF): IGF-I and II
- Transforming growth factors (TGF): TGFβs 1-3
- Fibroblast growth factors acidic and basic (aFGF and bFGF)
- Interleukins(IL): IL-1β; ?IL-6; IL-8
- Tumor Necrosis Factors (TNF): TNF a
- Colony stimulating factor (CSF): M-CSF
- Others:Prostaglandins PTH-RP

Lubrication and wear

The predominant method of lubrication of articular cartilage during joint motion is elastohydrodynamic lubrication. This occurs when pressure in the fluid film deforms the articular surface, increasing the surface area and reducing escape of fluid from between the surfaces as they glide over each other. Other methods of lubrication include boundary lubrication (in which a lubricating glycoprotein prevents direct surface contact of the articulating surfaces), boosted lubrication (where the solvent part of the lubricant enters the articular cartilage which leaves the hyaluronic acid complxes acting as a lubricant) and weeping lubrication (which describes the ability of articular cartilage to exude or imbibe fluid as the joint surfaces glide over each other providing self lubrication). The efficiency of these lubrication processes means that wear in synovial joints is minimal.

Effects of injury

Deep lacerations of articular cartilage extending beyond the tidemark heal with fibrocartilage produced by undifferentiated mesenchymal cells. Superficial lacerations do not heal, although some proliferation of chondrocytes may occur. Immobilisation of joints leads to atrophy of the articular cartilage and therefore continuous passive motion is believed to be beneficial to healing.

Summary

The relationship of the composition of articular cartilage to its structural integrity and function enhances our understanding of the effects of ageing, degenerative diseases and injury to this tissue. Many articular cartilage growth factors have been identified, but further investigation of the mechanisms of genetic regulation of articular cartilage is required. Manipulation of these processes may lead to future advances in the treatment of degenerative diseases and injury.

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RESEARCH NURSES IN ORTHOPAEDICS

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Nursing research is complex, and relatively little nursing research has been undertaken (Bassett and Hopkins 2001). The role of research nurse in trauma and orthopaedics is vast and multi-faceted, and can vary considerably (Williams and Gumbrell 1990), but can be extremely important to the successful implementation and completion of clinical studies. The research nurse is involved in all aspects of the research process, including assisting in the initial writing of the protocol. Successful coordination of multidisciplinary, collaborative research relies heavily on the qualities that constitute the "art" of nursing, especially those of interpersonal communication skills (Martin 1994). Whilst having an in-depth knowledge of the research process is fundamental to the research nurse role, past experience will also determine the feasibility of a planned project (Dunn 1991). The role involves the education of clinicians and nurses about the study protocols, and strengthening the links between clinicians and researchers can help to enhance this process.

The research nurse can enroll patients into studies, administer study interventions, and record data, acting as the link between the study subjects and the investigative team (Pranulis 1997). Conflict between roles as caregiver versus researcher can occur (Hagle, Barbour, Flynn, Kelley, Trippon, Braun, Beschorner, Boxler, Hange, McGuire, Bressler and Kirchhoff 1987), and therefore attempts should be made to minimise such conflicts (McGuire et al 2000). The nurse has to balance patient advocacy and responsibilities to the study and the study contributors (Stanfield and Simon 1991) to ensure that the role is carried out proficiently.

Scientists often tend to function under the illusion that, when a research study is planned, patients will respond like "experimental subjects" (Gross and Fogg 2001). In our setting, the research nurse is responsible for the screening of all potential study patients according to the eligibility criteria central to the study. This is often time consuming, especially in the constraints of clinics when patients have to see so many members of the multi-disciplinary team, and regular hospital staff have many other duties that compete for their attention (Friedman et al 1998).

The research nurse should use strategies to ensure adherence by informing the patient in as much detail as possible on what the trial involved and what was expected from them: a truly informed participant is a better adherer (Becker 1990 and Green 1979). The provision of an information sheet to take away also reinforces what has already been discussed. Good communication skills and a more thorough delivery of the intervention are vital in ensuring that all members adhere to the protocol to ensure the trial runs smoothly and the results may be generalized.

The research nurse must ensure that the patient is given all the necessary information to make an informed choice, and must promote the interests of the patient (UKCC 1992). The patient must be given the opportunity to think over the information, thereby offering the patient a choice as to whether to participate in the study (O'Brien 1997).

The research nurse's sensitivity to the moral implication of the research, and firm adherence to a professional code of practice, ensures sound foundations for the security and well being of all who participate in the research or contribute to the process in any way. Patients' perception of quality and satisfaction with care appear to be strongly connected with impressions of practitioner interpersonal and clinical competence, and the nature and significance of the relationships cultivated between the nurse and the patient (French 1981; Kitson 1986 and Cleverley 1990). Providing an honest but approachable relationship with the patient/client can help to ensure patients feel both comfortable in entering research studies and also feel satisfied with the process.

Although the roles and responsibilities of research nurses involved in clinical trials and studies have been described (Crowley, Somelofski, Hill, Smith and Buchwald 1988; Engelking 1991; Melink and Whitacre 1991; Seguin 1990; Stewart 1990 and White-Hersey and Nevidjon 1990), published nursing research on the clinical research nurse role is lacking. A multidisciplinary team approach to research helps to disperse the traditional boundaries between health professionals, between doctor and patient, and between managers and clinicians. This enables a no-blame culture, excellent leadership and an ethos of staff that feel valued and supported (Halligan and Donaldson 2001). Involving a wide range of stakeholders in uncovering the best available evidence, and ascertaining the priorities and benefits from the facts, leads to a sense of ownership and involvement (Kitson, McMahon, Rafferty and Scott 1997). It allows for a culture more receptive to research and the changes associated with it, and it emphasizes the importance in ensuring evidence-based quality patient care.

The research nurse can help to establish dedicated research clinics. This ensures that patients are followed up and reviewed according to the protocol, and allows for continuity of patients involved in the clinical studies. The research clinics allow for time to follow-up patients without any interruptions, although follow-up can be scheduled as much as possible to coincide with appointments with the medical staff so as to inconvenience the patient as little as possible.

In conclusion, the role of the research nurse in clinical research can be challenging. Conflict and animosity can be prominent features initially; as staff may feel the role impinges on systems already in place and may interfere with already overburdened job roles. The research nurse role carries a considerable amount of clinical autonomy (Johnson 1986 and Xanthos et al 1998), and yet much experience can be gained by the whole research team while properly interacting in a constructive fashion.

REFERENCES

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BONE BRUISING AND BONE MARROW EDEMA SYNDROMES: incidental radiological findings or harbingers of future joint degeneration?

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INTRODUCTION

Increasing use of magnetic resonance imaging for musculoskeletal injuries over the last decade has alerted clinicians to "bone bruising", a phenomenon previously undetected on conventional radiographic techniques (1-12). This entity is recognised as focal signal abnormalities in subchondral bone marrow and the appearances are thought to represent microtrabecular fractures, haemorrhage and oedema without disruption of adjacent cortices or articular cartilage. Since the late 1980's, bone bruising has been increasingly identified in association with soft tissue knee injury, in particular anterior cruciate ligament rupture and, to a lesser extent, injuries of the hip joint and foot. Although some authors suspect these lesions may account for symptoms of pain and have prognostic implications, there are few substantial reports to date clarifying the short-term implications, exact time to resolution and long-term sequelae and their clinical significance is still uncertain.

Bone marrow edema syndromes with no history of trauma, are also increasingly recognised, particularly in the hip joint, but increasingly in the knee joint. Whilst initially assumed to be a precursor of osteonecrosis, the scientific evidence is conflicting and at present they are best considered closely related diseases with overlapping clinical and radiological presentations. Most recently, the presence and persistence of marrow edema patterns in early osteoarthritis are showing promise as a potential marker of actively progressive disease.

DIAGNOSIS OF BONE BRUISES AND MARROW OEDEMA

The subcortical marrow cavity consists of cancellous bone that usually demonstrates fatty marrow at all ages. The normal marrow signal on MRI parallels that of subcutaneous fat-high on conventional T1-weighted and intermediate on T2-weighted spin echo sequences. A typical bone bruise appears as an area of signal loss on T1 images and high signal intensity on T2 images, as a result of increased water content in the injured marrow. Further information can be gained with Short T1 Inversion Recovery ("STIR") imaging when signal from normal medullary fat is markedly suppressed and bone bruises show increased intensity. Distinction between bone bruising and marrow oedema syndromes is primarily based on a clinical history of trauma, as the radiological features are largely indistinguishable.

CLASSIFICATION OF BONE BRUISES

Mink (6) was the first to identify bone bruising as a distinct entity in 1987 and several authors have since attempted to classify the lesions (3,5,12). Some confusion exists however, in distinguishing bone bruises involving only the marrow, and "occult" fractures, undetected on conventional x-ray, which breach the adjacent cortex or osteochondral surface on MRI. Vellet (12) divided true subcortical lesions into three types dependent on their characteristic bruising pattern - reticular, geographic and linear. He described reticular lesions as regions of "reticular serpiginous stranding" with variable degrees of coalescence within the marrow compartment but distant from the adjacent cortices and articular cartilage. "Geographic" lesions are characteristically large, amorphous, coalescent and continuous with the adjacent cortical bone and are the commonest type seen. Scant attention has been paid to these classifications, as they contribute little to understanding the underlying pathology.

INCIDENCE OF BONE BRUISING

Much of the literature to date has focused on bone contusions around the knee joint. Lynch reviewed 434 consecutive patients with acute knee injury and found an incidence of 20%, the majority (77%) associated with anterior cruciate rupture (3). Subsequent authors have almost exclusively focused their attention on the ACL injured population with strikingly consistent findings (1,2,7-11,13). Scans in the acute phase following injury consistently found more than 80% of acute ACL tears had contusions on MRI (8-10,13). Studies done which included patients scanned over a longer period had a smaller incidence ranging from 40-56% (1,2,11).

The pattern of bone contusions associated with ACL tears is very distinctive. In Spindler's series, 86% and 67% of contusions involved the lateral femoral condyle (LFC) and lateral tibial plateau (LTP) respectively and bruising of both occurred in 56%. Lesions in the medial femoral condyle (7%) and tibial plateau (21%) were less common (10). The notion that "matching" lesions in the lateral compartment reflected the valgus force on the knee at the time of injury was supported by Kaplan in her review of 100 MRIs of acute ACL tears (2). All 56 knees with contusions had posterolateral tibial lesions and this was the only finding in 43% of patients, whilst 48% had lesions in both the posterior LTP and LFC. In 200 MRIs without radiological ACL injury, posterolateral tibial bruising was found in only 3 patients, all of whom were later found to have an ACL tear at arthroscopy, suggesting that posterolateral tibial bruising is a pathognomonic sign of ACL injury. McCauley also found a high specificity of 97% for posterolateral plateau contusions alone and 100% when combined with lateral femoral condyle contusions as markers of ACL injury (4).

The preponderance of contusions in the lateral compartment with ACL rupture correlates with the mechanism of injury. The tibia subluxes anteriorly relative to the femur, the lateral plateau subluxing more than the medial side. If this traumatic "pivot shift" occurs with enough axial and valgus force, it is conceivable that a unique pattern of "kissing-contusions" may occur in the middle (weight-bearing) portion of the LFC and the posterior aspect of the LTP as the bones are compressed against one another. The posterior aspect of the LTP may be structurally weaker than the LFC and therefore injured most often. Kaplan's finding of the invariable presence of posterolateral tibial bruising would support this theory. It has also been shown that some injury of the popliteus-arcuate capsuloligamentous complex is commonly associated with bone contusions of the posterior LTP (13), lending

support to contemporary opinion by clinicians that subtle injury to the posterolateral corner is frequently overlooked and may account for less optimal outcome after ACL reconstruction.

Murphy made some interesting observations by distinguishing between complete and partial tears of the ACL (7). Whilst bruising of the posterolateral tibia (94%) and lateral femoral condyle (91%) was common with complete tears, only 17% of patients with partial tears had contusions. He suggested that the presence of these MRI lesions indicates ACL "insufficiency" and may influence decisions about reconstruction. These findings were supported by Zeiss, who found that 80% of "partial tears" with contusions were high grade injuries that eventually led to complete rupture within 6 months (14).

Whilst the pattern of lateral joint contusions is explained by axial and valgus load, the mechanism of medial tibial plateau injury is not clearly understood. In 25 patients with medial tibial plateau contusions, all associated with ACL rupture and lateral lesions, Kaplan found consistent injury to the posterior horn of the medial meniscus or meniscocapsular junction (15). She suggested contusions of the posteromedial lip of the tibial result from a "contrecoup" impaction injury as the knee reduces and they imply associated medial meniscal injury. Speer observed a relatively high incidence (29%) of MTP lesions in alpine skiers (9). It has been proposed that, at the moment of ACL rupture, the skier's knee is non-weight bearing and the ultimate tearing force is rotational. The expected number of contusions from axial loading should be less, but this is not supported in Speer's group. However, the higher incidence of posteromedial tibial plateau contusions and meniscal injury may reflect a different mechanism of injury in skiers and requires further investigation. The mechanism behind infrequent anteromedial femoral condyle contusion with ACL rupture is also open to question. Recent work has implicated associated clinical disruption of the posterolateral corner but this theory needs substantiation in large studies (16).

Recent literature has also highlighted contusions with other "non-bony" knee injury. Miller reported an incidence of 45% associated with medial collateral ligament injury, almost all lesions involving the lateral femoral condyle (17). Contusions of the lateral femoral condyle (81-100%) and the medial patella (30%) after patellar dislocation (18-21) and "isolated" bone bruising with uneventful resolution (22) are both recognised. Traumatic hip dislocation has also been implicated in lesions of the femoral head (23) and the ipsilateral knee from dashboard impaction (24). Lesions of the talus and medial malleolus occur in up to 40% of lateral ligament ankle sprains (25-29) and bilateral calcaneal contusions after axial loading has also been reported (30).

CLINICAL, OPERATIVE AND HISTOLOGICAL FINDINGS

Difficulty arises in identifying clinical signs and symptoms directly attributable to the bone bruising, because of the spectra of associated injuries. However, patients with contusions appear to have a more protracted clinical recovery, with greater effusions and pain scores at matched time intervals and a slower return of motion (31).

Arthroscopic evidence of damage to the joint surface overlying contusions is not universally supported in the literature. Several authors found no arthroscopic evidence of osteochondral lesions corresponding anatomically with contusions in the acute phase (1,12). Coen described normal joint appearance but "dimpling" of the cartilage over geographic femoral bruises when probed (32). Several authors describe articular lesions later at the time of ACL reconstruction (9,10). Speer found a small incidence of fissuring (6%) overlying lateral femoral condyle and posterolateral tibial plateau contusions (9). Although Spindler found 46% of patients had articular lesions, many did not correlate with contusion. The only significant relationship was in the lateral femoral condyle where 40% of contusions had an overlying lesion (10). In contrast, Johnson consistently found evidence of articular cartilage injury over femoral condyle contusions, varying from subtle indentation when probed, to severe fibrillation, fissuring or overt chondral fracture (33).

Some interesting histological information has arisen from biopsy at varying time periods (33-35). In acute lesions, Rangger found microfractures of the trabecular bone, oedema and bleeding in the fatty marrow (34). In Johnson's series, all patients had articular cartilage and subchondral bone changes at ACL reconstruction. Chondrocytes in the superficial zone of the articular cartilage showed different stages of degeneration, and loss of matrix proteogylcan and variable osteocyte necrosis in the underlying subchondral bone was noted (33). Fang supported the evidence for proteoglycan loss and also found a 10-fold increase in matrix protein degradation products in the synovial fluid from injured compared with uninjured knees (35). This clinical data supports previous animal studies suggesting blunt trauma to articular cartilage produces profound changes in its histologic, biochemical and ultrastructural characteristics in the absence of surface disruption (36,37) and lends scientific evidence to the notion that bone bruising may be a precursor of posttraumatic arthritis.

RESOLUTION OF BONE BRUISING

Few studies to date address resolution of bone contusions or long-term sequelae. Vellet demonstrated complete resolution of MRI contusions at 6-12 months but osteochondral sequelae in 67% of lateral femoral condyle lesions (12). The commonest finding was an overt cartilage defect (48%), but features of osteosclerosis, cartilage thinning and osteochondral defects were also seen. No articular defects occurred over associated reticular bruises in the posterolateral tibial plateau. Bretlau recently reported persistent bruising in 69% and 12% of patients rescanned at 4 and 12 months respectively (38). Miller, in contrast, suggested the majority of lesions resolved in 2-4 months but his study involved patients with isolated medial collateral ligament injury, the benign nature of which may have influenced the rate of recovery (17).

Much anecdotal evidence that contusions resolve within the first few months is inferred from earlier studies on incidence. In Graf's series with a 48% incidence of contusions, no lesions were seen in scans later than 6 weeks

(1). Tung reported a significantly shorter interval from injury to MR imaging when bone bruising was present (mean 4.3 weeks) than in those with normal medullary signal (mean 24 weeks) (11). Dimond found scans were consistently negative for contusions by 6 months, but showed a greater incidence of meniscal tears and chondromalacia (39). Whether these are secondary injuries from instability, or indeed sequelae of a resolved bone bruise is open to question. Two year follow-up studies suggest that 10-15% of patients have persistent marrow oedema at 2 years and up to one third have some evidence of subchrondral osteonecrosis or articular cartilage degeneration (40,41).

BONE MARROW EDEMA SYNDROMES

The first use of the term "bone marrow edema" was by Wilson and collaborators in 1988 (75). They found ill-defined bone marrow hyperintensities on T2-weighted MR images in patients with debilitating knee and hip pain. Corresponding standard radiographs were normal or demonstrated non-specific osteopenia. The authors termed this condition bone marrow edema because of "the lack of a better term and to emphasize the generic character of the condition". According to findings of a Medline search starting at 1966, this term was not mentioned before 1988 in the radiology or pathology literature, which probably relates to the fact that MR imaging was not used widely for musculoskeletal disease before the mid-1980s. However, Roemer et al. (41) conclude that widely used term BME should be replaced by "ill-defined signal intensity" as there are many similar but unrelated and non-specific MRI abnormalities. They claim that post-traumatic osteonecrosis, as reported in the literature, must be a rare event after acute knee trauma.

Whilst marrow edema is a recognised non-specific finding in pathologies such as infection, neoplasms and avascular necrosis, the phenomenon of transient bone marrow edema syndrome (BMES) has received much attention in recent years. Most commonly seen in the hip joint, it was initially thought to be synonymous with transient osteoporosis and a possible precursor of avascular necrosis. However, the onset of radiological osteopenia within weeks of clinical symptoms distinguishes transient osteoporosis from BMES, although both are characterised by complete recovery, without intervention.

It has been suggested that transient osteoporosis or the bone marrow edema syndrome may be the initial phase of femoral head osteonecrosis but there is little radiological or histological evidence to date to support this hypothesis. In a series of 200 hips, Kim could not identify a bone marrow oedema pattern on MRI in the early stages of femoral head necrosis (42). Structural damage of the head seemed to result in the later appearance of marrow edema and the development of pain, suggesting that the edema pattern is a secondary reaction associated with the inflammatory response to subchondral fracture.

Various authors have treated BMES of the hip with core decompression, showing marked acceleration in recovery compared with conservative measures (43-45). Interestingly, no osteonecrosis followed with either treatment. Histological examination of the core specimens from the earliest series suggested evidence of early necrosis (46). However, recent studies report edema without osteoporosis or osteonecrosis (43-45). Increased osteoblast activity and transient decrease in mineral density are described but osteoclast resorption is rarely seen. Live trabeculae and active bone formation, however, infer increased repair capacity and may explain the spontaneous reversibility of this syndrome.

The pathophysiological event that triggers BMES is still a complete enigma. Ischaemia has been suggested as the initiating factor. Koo reported angiographic findings of increased femoral head perfusion suggesting a vasomotor response in the pathogenesis (47). The present consensus of opinion is that bone marrow edema syndrome, transient osteoporosis and avascular necrosis may have a common pathophysiology but are distinguished by the early potential for reversibility.

The recent increasingly frequent findings of non-traumatic bone marrow edema in the knees and feet of asymptomatic athletes (48,49) and others with pain (50,51), suggests that BMES is more common than previously recognised.

MR imaging is sensitive to changes in subchondral bone marrow (especially if fat suppression is used), which are difficult, if not impossible, to assess arthroscopically. Those changes reflect changes in overlaying cartilage, but the nature of bone lesions remains unclear. In recent years advances in MRI imaging of articulating surfaces have shown previously unknown subchondral bone changes following cartilage repair: edema-like signal, cysts, irregularity of subchondral bone plate, mismatch with adjacent plate, intralesional osteophytes, etc. Persistent BME and pain following autologous chondrocyte implantation (ACI) repair seem to suggest complications or failed repair. Abnormal subchondral bone marrow signal after cartilage repair is associated with failure of repair tissue integration at different levels. Failed integration of the repair tissue to bone appears as diffuse edema-like signal, while failed integration of the repair tissue to adjacent cartilage appears as focal edema-like signal, fissures, cysts, etc. In summary, early edema-like MRI changes may reflect normal healing, while persistently abnormal marrow signal usually indicates a problem with cartilage repair (76).

BONE MARROW EDEMA AND OSTEOARTHRITIS

Recent studies provide some evidence that marrow edema in osteoarthritis joint is strongly associated with both pain and disease progression. In a large series of arthritic knees, Felson found bone marrow lesions in 77.5% of patients with pain, compared with 30% in those without pain (52). In a further study, he suggested that BME lesions increase the risk more than six-fold for disease progression at a year (53). Pessis also examined the predictive value of subchrondral edema and found no patient without oedema on initial MR assessment but 40% of those with lesions developed worsening chondropathy at one year (54).

Cartilage degeneration, although fundamental to the pathogenesis of osteoarthritis, is not the site of origin of pain, which is the predominant symptom of osteoarthritis. Patients with osteoarthritis of the knee often report no or minimal pain while walking but considerable pain after

activity, especially at night. These delayed responses can be explained by findings such as those reported by Felson and colleagues - they reflect the time it takes for the marrow spaces to react. Edema of the bone marrow has also been observed in patients with painful, transient regional osteoporosis, which is usually symptomatic for 6 to 12 months. Periosteal edema along with marrow edema has been seen on MRI in patients with otherwise unexplained medial tibial pain after trauma. MR imaging has demonstrated other bone marrow lesions in patients with bone pain, such as those in osteoid osteoma and with sickle-cell crises. Magnetic resonance imaging can also detect early subarticular erosions in rheumatoid arthritis.

Impaired venous drainage from the bone marrow has been suggested as a cause of pain in patients with osteoarthritis, since the resulting venous hypertension would increase intraosseous pressure in the closed spaces of the bone marrow compartments. Such venous hypertension would contribute to the development of marrow edema and may be an aspect of the phenomenon that Felson and colleagues observed. The development of venous hypertension and bone marrow edema may also be related to the development of cysts in the subchondral bone in osteoarthritis. These observations may explain pain that occurs before OA changes are visible on standard radiographs. Ordinary radiographs show the effect of degeneration of joint cartilage as narrowing of the space between articulating surfaces. However, patients can have considerable pain despite a normal-looking cartilage space, or pain can be mild despite marked narrowing. (77).

It is possible in the future that MR may be a useful screening tool for identifying patients with marrow oedema and high risk of arthritic progression.

DISCUSSION

As a recently recognised entity, the natural history of bone bruising is unknown. If it represents trabecular microfracture, as the histological evidence to date suggests, one can reasonably expect bony healing of the subchrondral lesion. Certainly, there is a consensus that most bone contusions heal in the short term. It has been proposed however, that increased stiffness of the healed bone may decrease the potential for the joint to dissipate load by deformation and this may also increase shear-stress at the bone cartilage interface, precipitating cartilage degeneration (55). However, it is also likely that the initial trauma insults the cartilage microstructure in its own right and the relative influence of the underlying bone bruise on chondral degeneration is still open to question. Further understanding of articular cartilage microstructure in the acute phase is needed, as evidence for chondral injury to date is based on macroscopic appearances and histology at the time of ACL reconstruction.

The high prevalence of bone bruises with ACL rupture has raised questions about its prognostic implications for this injured population. Posttraumatic arthritis is an established complication of nonoperative treatment of ACL rupture (56-66). Some radiological degeneration is seen in up to 80% of patients as early as 3 years post injury (60,62). McDaniel and Dameron found 37% of patients had profound degeneration at 14 years (63). Whilst associated meniscal injury was often considered the determining factor, several authors have shown similar rates of long-term degeneration, regardless of initial meniscal damage (64,66). Two possible explanations exist. Chronic instability may provoke secondary injury to menisci seen to be intact at the time of ACL rupture (67,68). Alternatively, initial damage to the articular cartilage may be the predominant prognostic factor and, if so, bone bruising may be the missing link. Sherman's observation that knees with concomitant medial collateral ligament injury degenerated significantly earlier than those with ACL/ meniscal tear patterns could be explained by a more traumatic impact to the lateral compartment with extensive bone contusions.

The commonly held belief that a knee with a chronic ACL injury develops cartilage wear and degeneration because of instability requires further review. The literature to date shows lack of documentation that ACL reconstruction prevents degenerative arthritis (57,59,69-71). Friederich and O'Brien have shown a similar incidence of radiographic arthritis at 5-10 years in surgically and conservatively treated knees, whilst Daniel found an increased incidence of degenerative change after reconstruction (57,59). Both these studies suggest that initial injury to the articular cartilage is the predominant precursor to joint degeneration and bone bruising may be the etiological factor. Long-term prospective trials comparing matched reconstructed groups, with and without bone bruising, will clarify this issue in the future.

Most of the literature to date has focused on ACL associated bone bruises. However, the long-term manifestations of bone bruising will be difficult to clarify in these patients because of the injury complexity and we need to identify better natural history models for follow-up studies. "Isolated" contusions and those associated with medial collateral ligament injury would seem ideal. The speculation that lesions may also occur with meniscal tears must also be explored. The incidence of posttraumatic arthritis after meniscectomy has historically been attributed to increased load-bearing in the affected compartment (72-74). However, contusions in the adjacent bone may be contributory in part.

Many answers on the enigmas of bone contusions will not be answered in the short-term. Future research needs to focus on longitudinal studies to establish natural history and further investigation into the pathophysiology of the lesions and the adjacent cartilage. Until such time as long-term studies are available, as clinicians we must assume that bone bruising as a specific entity is a harbinger of posttraumatic arthritis and practice a cautious approach to management of associated knee injuries.

REFERENCES

Please visit www.isakos.com to view the references from this article.

President's Message *continued from page 2*

• Develop method for equipment exchange between developed and developing nations.

The ISAKOS *Global Connection* Campaign

ISAKOS has initiated the formation of a Global Connection fund under the leadership of members Barry Tietjens, New Zealand and Freddie Fu, USA. In 2002, ISAKOS launched a fundraising campaign to further education in the form of fellowships, workshops, multi-center studies and consensus reports. Industry has since committed three million dollars over the next five years. This is a fantastic accomplishment, making it possible for ISAKOS to offer successful, high quality events in the coming years.

ISAKOS Strategic Advisory Task Force

To respond to the wishes of our members and donors, we have now formed the Strategic Advisory Task Force (SATF), under the leadership of Peter Fowler, Canada and myself. The SATF will develop ISAKOS educational activities based on campaign pledges and projected revenue.

Educational activities will include global regional hands-on workshops, current concept consensus meetings with related publications and international multi-center trials.

The SATF will further develop the ISAKOS International President's Council, bringing together the leadership of the regional societies to promote continued dialogue and collaboration. They will coordinate global retreats for the ISAKOS leadership with corporate supporters.

Arthroscopy: The Journal of Arthroscopic and Related Surgery:

Arthroscopy: The Journal of Arthroscopic and Related Surgery will continue to be the official ISAKOS journal. In addition, we will consider including supplemental journals to include the *American Journal of Sports Medicine* and the ESSKA *Journal* available to our members.

I am grateful for any comments on how we together can improve this extraordinary international society. The leadership must always listen to its members, be on top of current development and plan for the future. You can always write to me via e-mail at per.renstrom@isakos.com with your suggestions on how we can improve ISAKOS.

I look forward to serving you over the next two years, with the aim that ISAKOS will be instrumental in leading international development.

What is the Global Connection: Expanding International Education Campaign?

The Global Connection campaign is a strategic, phased approach to increasing the society's support for its members and their specialties by implementing the following priorities:

- ▼ Providing new ISAKOS-sponsored regional hands-on workshops
- ▼ Enhancing ISAKOS-approved teaching centers and courses in locations around the globe
- ▼ Utilizing video broadcasting capabilities to initiate web casts of live procedures to a geographically diverse audience
- ▼ Offering CME-accredited education opportunities to our members
- ▼ Initiating special committee projects and traveling fellowships
- ▼ Partnering with regional societies and industry leaders to collaborate in ways that enhance the overall profession
- ▼ Investing in the infrastructure and operations of the society in order to implement these projects

Editor's Note *continued from page 2*

ISAKOS, as well as in practice as evidenced by the articles you'll read. Vladimir Bobic, MD, United Kingdom, and Dorothy Niall present an in depth article on subchondral edema, and the significance for cartilage injury and repair. Also please note the ISAKOS Web site where you can download many additional ISAKOS current concepts articles. Keep checking back - all articles that appear in the newsletter will also be placed online!

Dr. Nicola Maffulli, a member of our Editorial Board, now chairs the Scientific Committee and its role as a review/advisory group for trials and studies undertaken by the other committees.

Learn about the Global Connection campaign, a strategic, phased approach to increasing the ISAKOS's support for its members and their specialties.

Read about the ISAKOS awards programs with several opportunities for researchers to receive recognition. Also note the application deadline for the 2005 Achilles and Trillat awards is September 1, 2004.

We're happy to bring a new feature beginning with this issue of the newsletter, called "What Are New Members Saying?" and think that you'll find it interesting.

Dr. Gary G. Poehling, ISAKOS Past President and current Journal Editor-in-Chief of Arthroscopy: The Journal of Arthroscopic and Related Surgery, provides interesting insight about the history of the Journal.

The steering committee and executive board will bring you up to date on plans for the next biennial ISAKOS Congress, which will be in Hollywood, Florida, USA in April, 2005.

The Congress will include surgical demonstrations, plenary sessions, hands-on workshops, symposia, posters, technical exhibits, a multimedia center and panel discussions on knee reconstruction, arthroscopy and joint preservation. Note the abstract deadline of April 1st. Learn how to submit your abstract online. There is a new streamlined online submission system which will ease the process - it will get here faster than you think! Mark your calendar and make plans now to join us at ISAKOS Congress in Florida!

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