XXVIII Congress of
S.I.T.E.M.S.H.

INTERNATIONAL SOCIETY FOR
SKIING TRAUMATOLOGY AND WINTER SPORTS MEDICINE

APRIL 3-5, 2008

FINAL PROGRAM

Delphi-GREECE

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CONGRESS SECRETARIAT

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CONGRESS VENUE

Conference Venue of European
Cultural Centre of Delphi
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WELCOME MESSAGE
from the Organizing Committee Chairman

The **XVIII Biannual Congress of International Society for Skiing Traumatology and Winter Sport Medicine (S.I.T.E.M.S.H)** will be held on 3-5 of April 2008, at the European Cultural Center, in Delphi, Greece.

S.I.T.E.M.S.H is an active society, working for more than 50 years in all fields of skiing traumatology, including epidemiology, injury types and patterns, causes and prevention of winter sport injuries, treatment, the role of equipment, etc.

The main topics of this Congress are:

- Epidemiology of skiing and snowboarding injuries
- Evolution of the sport injuries in ski resorts
- New trends in the treatment of:
  > ACL ruptures > Shoulder injuries > Ankle sprains etc.
- Biomechanics
- The role of equipment
- Prevention in snow activities

Delphi is a world famous area for the unique archaeological interest, the amazing museum and the particular role in the Ancient History. Delphi region is just two hours drive from Athens International Airport, full of tourist facilities: hotels, restaurants, bars, banks, market-place, shops, etc. Beside all these the spectacular Delphic View and Landscape (protected by UNESCO) creates an outstanding scenery that guarantees an unforgettable stay.

The European Cultural Center of Delphi is a well equipped congress center located in the middle of a forest offering wonderful sea view, just a few minutes walking from the center of Delphi town.

Just 30 minutes drive from Delphi is located the Parnassus Ski resort, the biggest ski resort in Greece, spanning an area from altitude 2450 to 1750m. April is an ideal month for skiing in Greece because of the sunny days, the good weather and good snow quality. And for those that they don't want skiing, just 15 minutes drive from Delphi is the Corinthian Bay where many small villages offer their beaches for spring leisure or swimming.

We are looking forward welcoming you in Delphi and Greece in April 2008.

On Behalf of the Organizing Committee

Athanasios Zacharopoulos, MD
Orthopaedic Surgeon
National Secretary of SITEMSH

COMMITTEES

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GENERAL INFORMATION

BANKS
Banks are open from 08.00 a.m. to 02.00 p.m. excluding weekends. ATM facilities are available.

CERTIFICATE OF ATTENDANCE
A Certificate of Attendance will be provided in your registration material.

CONGRESS BADGE
For security purposes, delegates, speakers, accompanying guests and exhibitors are asked to wear their name badges to the scientific sessions and social functions. Entrance into sessions is restricted to registered delegates only. If you misplace your name badge, please go to the Registration Desk to organize a replacement.

VENUE INFORMATION
The Conference Venue of European Cultural Centre of Delphi is a typical example of the architecture of the Modern Movement dates back to 1960 and was designed by Professor A. Kitsikis and the architect A. Lambrakis.

CREDIT CARDS- CURRENCY EXCHANGE
Most major cards (AmEx, Dinners Club, MasterCard, and Visa) are accepted at hotels, department stores and some restaurants. The Greek currency unit is Euro. Please note that identification (passport) is requested when exchanging money. All banks in Greece are authorised to convert foreign currency to Euro.

ELECTRICITY
The electrical supply in Greece is 220 Volts, AC 50 Hz.

INSURANCE
The Organizing Committee or S.I.T.E.M.S.H will accept no liability for personal injuries sustained or for loss or damage to property belonging to congress participants, during the congress. It is recommended that participants arrange their own personal health, accident and travel insurance.

LANGUAGE
English is the official language of the Congress. No translation will be provided.

MOBILE TELEPHONES
Delegates are asked to switch off their mobile phones when in sessions.

REGISTRATION DESK OPENING HOURS

Thursday, April 3	09.00 - 11.00 & 15.00 - 20.00
Friday, April 4	08.00 - 11.00 & 16.00 - 20.30
Saturday, April 5	08.00 - 11.00 & 16.00 - 19.30

SPEAKER PREPARATION ROOMS

It is requested that you visit the Speaker Preparation Room to confirm your audiovisual requirements at least two hours prior to the start of your session. The Speaker Preparation Room will be open at the same time as the Registration Desk hours.

TRANSPORTATION

The closest airport is ATHENS AIRPORT and busses will be available on specific dates and times only. Any other request will be treated and charged individually.

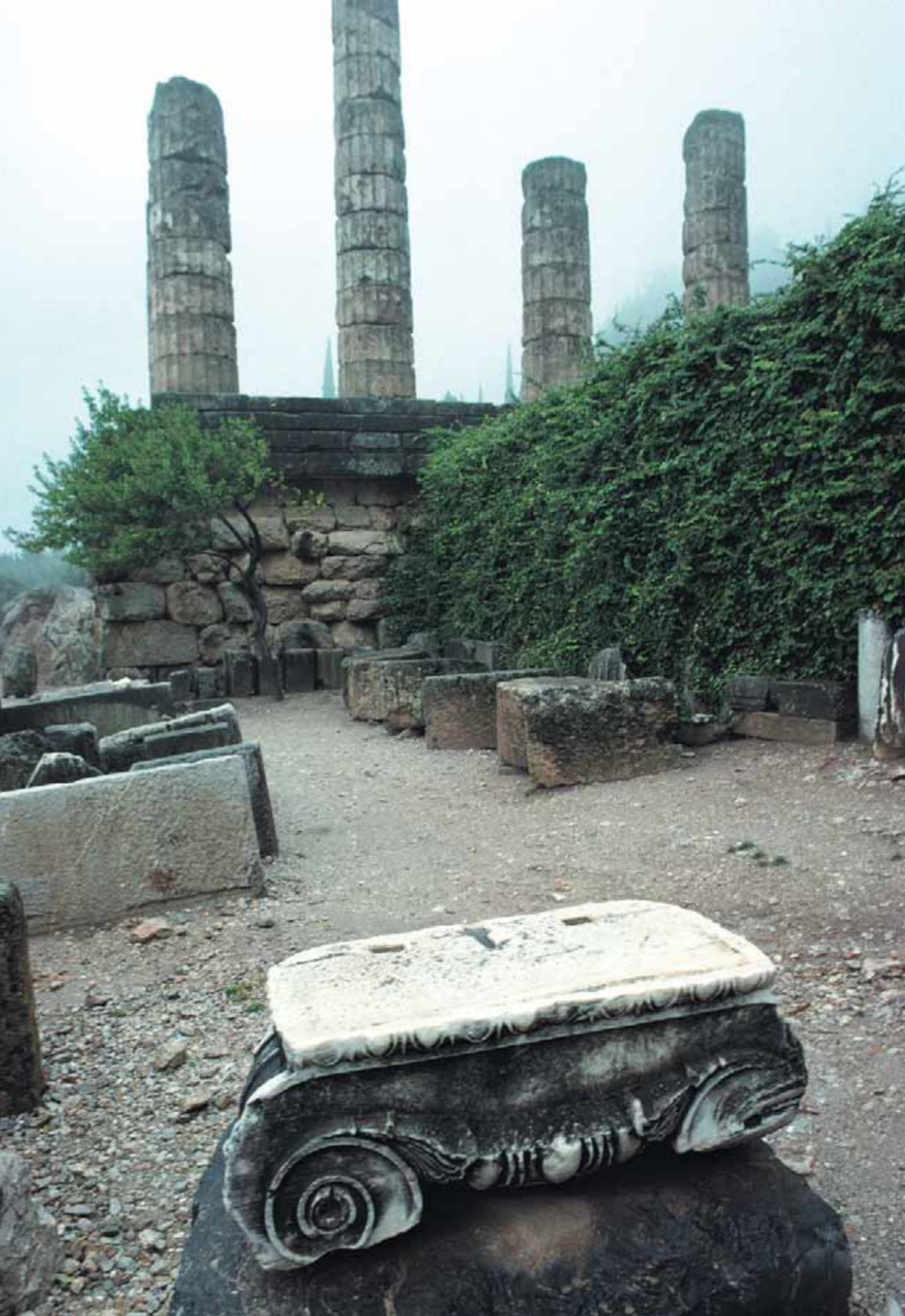
HISTORY OF DELPHI

According to Greek mythology, Zeus released two eagles, flying in opposite directions, and the spot where they eventually met was Delphi. Over the years, Delphi became the centre of religion with a temple dedicated to Apollo built on the site and the Oracle of Delphi - a priestess known as the Pythia was appointed. She prophesied on various matters including administration and religion.

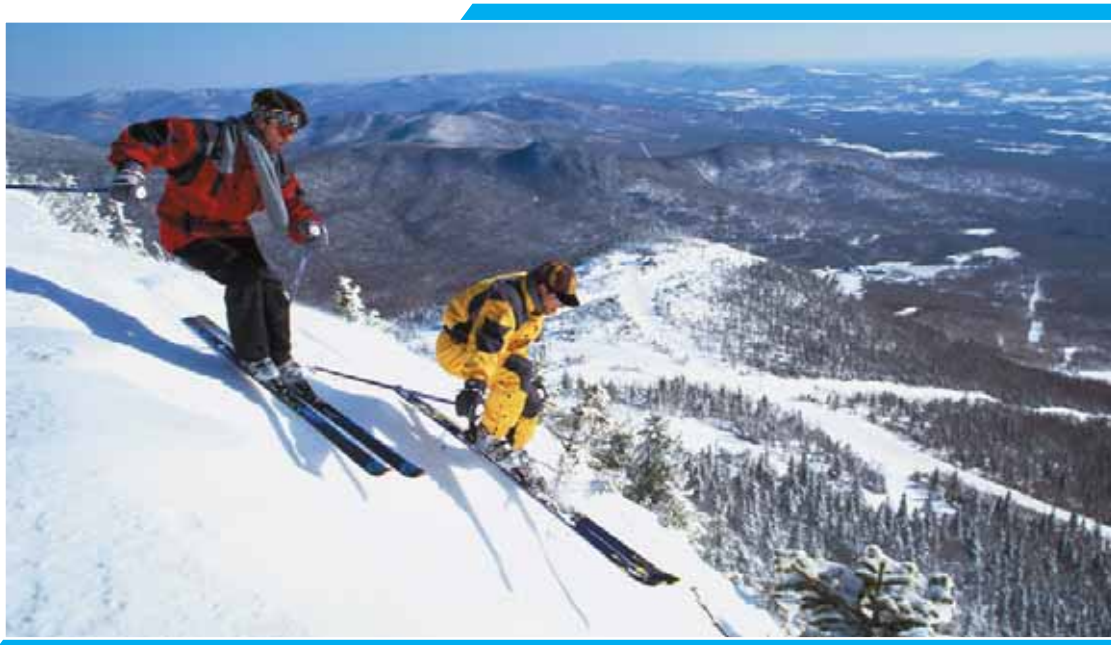
All that remains at Delphi today are some impressive ruins. The Temple of Athena, the Gymnasium and the Stadium- the latter the ancient site of ceremonial chariot races- are among the major ruins in the area. The complex on Mt Parnassos is vast, and includes a number of important structures. The spring where petitioners heading for the Pythia would perform ablutions, the Castalia Fountain, still flows along its age-old path.

An ancient theatre and the circular Tholos Temple are among the other buildings which still remain- if only in part. Nearby, the local Archaeological Museum houses finds from Delphi. These include sculpted gold-and-ivory heads of Apollo and Artemis; friezes from the temples; a famous image of a bronze charioteer and other interesting relics.

Pride of place, however, is occupied by the Temple of Apollo. It stands on the lip of a crevasse, a ruined Doric building which was rebuilt after being burnt down in the 4th century BC. It's a much-frequented building, and some visitors still swear to a touch of divinity in the air.



SCIENTIFIC PROGRAM



Thursday, April 3, 2008

09.00 – 11.00 Registration

11.00 – 15.00 **Skiing**

Epidemiology: Free Papers

Moderators: **A. Wicker** (Austria), **A. Zacharopoulos** (Greece)

16.00 – 16.10 **Evaluation of Alpine Skiing Injury in North – West Peloponnese** **01**
A. Arvanitis[1], D. Giannopoulos[2], M. Chronopoulou[1], S. Voulioti[2]
[1]*General Practitioner trainee, "St. Andrew" General Hospital, Patras, Greece*
[2]*General Practitioner, Health Center of Varda, Greece*

16.10 – 16.20 **Snowboarding Injuries in Snow Center of Kalavrita** **02**
A. Arvanitis[1], D. Giannopoulos[2], M. Chronopoulou[1], S. Voulioti[2]
[1]*General Practitioner trainee, "St. Andrew" General Hospital, Patras, Greece*
[2]*General Practitioner, Health Center of Varda, Greece*

16.20 – 16.30 **Wintersport Injury Statistics 2000-2005/06 of the Greater Innsbruck Area**
S. Falle, J. Oberladstatder, Ch. Fink, A. Genelin, M. Blauth

16.30 – 16.40 **Injuries to World Cup Ski and Snowboard Athletes** **03**
T.W. Flørenes[1], L. Nordsletten[1,2], S. Heir[1,3], R. Bahr[1]
[1]*Oslo Sports Trauma Research Center, Norwegian School of Sport Sciences, Oslo, Norway*
[2]*Ullevaal University Hospital, Oslo, Norway*
[3]*Martina Hansen Hospital, Baerum, Norway*

16.40 – 16.50 **The Best Method to Register Injuries Among World Cup Ski- and Snowboarders** **04**
T.W. Flørenes[1], L. Nordsletten[1,2], S. Heir[1,3], R. Bahr[1]
[1]*Oslo Sports Trauma Research Center, Norwegian School of Sport Sciences, Oslo, Norway*
[2]*Ullevaal University Hospital, Oslo, Norway*
[3]*Martina Hansen Hospital, Baerum, Norway*

16.50 – 17.00 DISCUSSION

Lecture

17.00 – 17.30 **A 16 Year Study of Alpine Skiing Injures from a Southern Lapland Ski Resort** **05**
L.G. Elmqvist (Sweden)

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[1]*Dep. of Traumatology and Sports Medicine, Innsbruck Medical University*
[2]*Dep. of Anaesthesiology and Intensive Care Medicine, Innsbruck Medical University*

18.20 - 18.30 DISCUSSION

18.30 - 18.50 *Coffee Break*

Equipment – Terrain Parks

Moderators: **M. Langran** (Scotland), **M. Koimtzis** (Greece)

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M.H. Binet (France)

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S. Werner (Sweden)

19.40 – 20.00 **The Role of Helmets in Injury Mitigation in Skiing and Snowboarding** 09
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20.20 – 20.50 History of Skiing
E. Eriksson (Sweden)

20.50 – 21.00 History of SITEMSH
P. Zucco (Italy)

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Friday, April 4, 2008

Knee I: Epidemiology

Moderators: **H. Paessler** (Germany), **N. Piskopakis** (Greece)

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[1]*Stockholm Sports Trauma Research Center, Karolinska Institutet; Stockholm, Sweden*

[2]*Capio Artro Clinic, Stockholm, Sweden*

[3]*Department of Health Sciences, Mid Sweden University, Östersund, Sweden*

08.50 – 09.00 DISCUSSION

Knee II: ACL

Moderator: **E. Eriksson** (Sweden)

09.00 – 09.15 **The Graft Choice in ACL Reconstruction in Elite Skiers**

P. Zucco (Italy)

09.15 – 09.30 **8-9 years Follow up of a Prospective and Randomized Study using BPT vs. Hamstrings for ACL Reconstruction in Implantfree Pressfit Technique**

H. Paessler (Germany)

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A. Mitsou (Greece)

09.45 – 10.00 **Partial ACL tears: Management with one Bundle Augmentation**

M. Hantes (Greece)

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Moderators: **A. Vidal** (Spain), **Ch. Giannakopoulos** (Greece)

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[1]*Orthopaedic Sports Medicine Center of Ioannina, Department of Orthopaedic Surgery, University of Ioannina, Ioannina, Greece*
[2]*HPER Biomechanics Lab, University of Nebraska at Omaha, Omaha, NE, USA*

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[1]*Rehab Centre Area 3; Cantalupa, Italy*
[2]*Biomechanics Laboratory, Federal University of Rio de Janeiro, Brazil*

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S. Werner (Sweden)

10.45 – 11.00 **Why Do Some ACL- Reconstructed Patients Not Return to their Sport**
S. Werner (Sweden)

11.00 – 11.10 DISCUSSION

11.00 – 15.00 **Ski Race**

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Amfilohia Rehabilitation Center

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[1]*Orthopaedic Sports Medicine Center of Ioannina, Department of Orthopaedic Surgery, University of Ioannina, Ioannina, Greece*
[2]*HPER Biomechanics Lab, University of Nebraska at Omaha, Omaha, NE, USA*

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B' Orthopaedic Department, "KAT" General Hospital of Athens

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M. Hantes (Greece)

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[2]*Capio Artro Clinic, Stockholm Sports Trauma Research Center, Karolinska Institutet; Stockholm, Sweden*

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[1]*Department of Health Sciences, Mid Sweden University, Östersund, Sweden*
[2]*Capio Artro Clinic, Stockholm Sports Trauma Research Center, Karolinska Institutet; Stockholm, Sweden*

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Saturday, April 5, 2008

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N. Tzanakakis (Greece)

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09.20 – 09.40 *Coffee Break*

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[1]*Department of Orthopaedic Surgery, Campus Bio-Medico Hospital. University of Campus Bio-Medico, Rome*
[2]*Department of Neurosurgery and Injury Prevention, St. Michael's Hospital. University of Toronto*
[3]*Health Surveillance and Epidemiology Division, Centre for Healthy Human Development. Public Health Agency of Canada*

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G. Escoda Alegret, B. Escoda Alegret, J. Escoda
Sales Centre Medic Pas de la Casa-Grau Roig, Grandvalira Ski Resort, Andorra

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16.40 – 16.50 DISCUSSION

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Centro Médico Teknon

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A. Wicker
Department of Physical Medicine and Rehabilitation, Paracelsus University Salzburg, Austria

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SOS Hungary Medical Service

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B. Escoda Alegret[1], J. Escoda Sales[1], R. Pajares[2]
[1]*Centre Medic Pas de la Casa-Grau Roig, Grandvalira Ski Resort, Andorra*
[2]*Ll. Rocafort Sector Pas de la Casa - Grau Roig - Encamp - Porte des Neiges Grandvalira Ski Resort, Andorra*

17.30 – 17.40 DISCUSSION

17.40 – 18.00 *Coffee Break*

Saturday, April 5, 2008

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19.20 – 19.30 DISCUSSION

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Moderator: **P. Zucco** (Italy)

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M.H. Binet (France)

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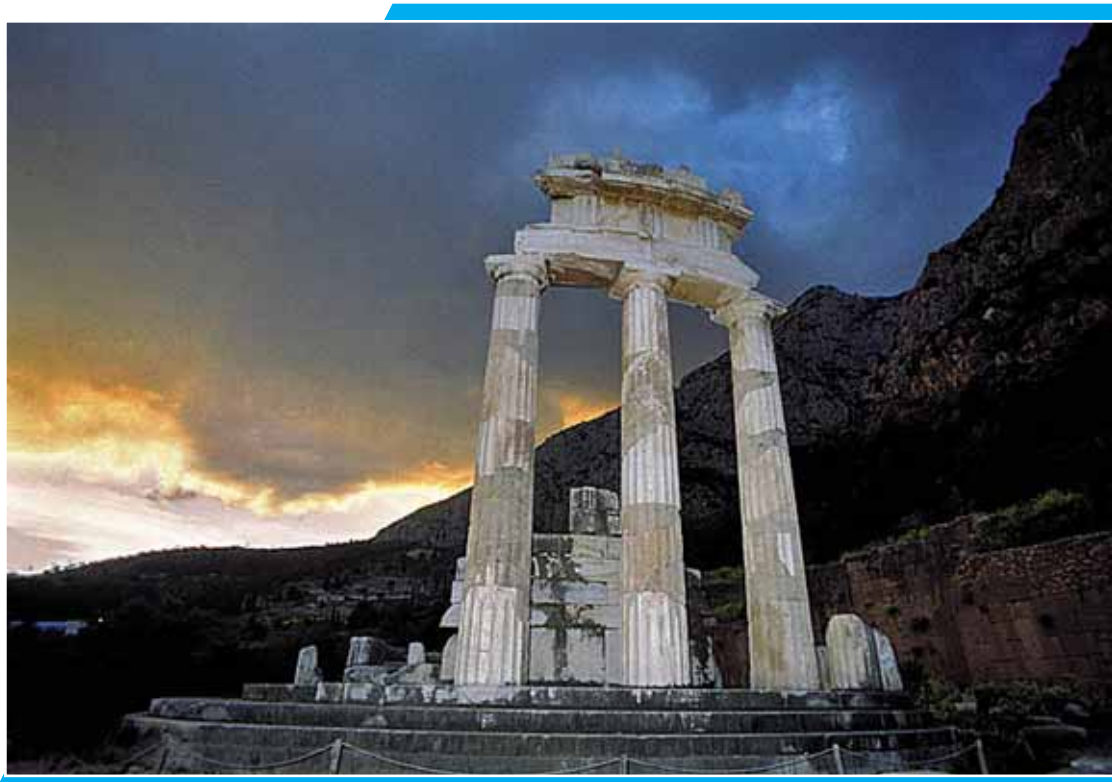
21.00 *Gala Dinner*

ABSTRACTS



1. EVALUATION OF ALPINE SKIING INJURY IN NORTH – WEST PELOPONNESE

A. Arvanitis[1], D. Giannopoulos[2], M. Chronopoulou[1], S. Voulioti[2]

[1]General Practitioner trainee, "St. Andrew" General Hospital, Patras, Greece

[2]General Practitioner, Health Center of Varda, Greece

BACKGROUND - AIM: To demonstrate the injury patterns of Alpine skiing in the north - west Peloponnese and evaluate potential risk factors.

METHODS: The medical records of the Hospital – Health Center of Kalavrita (HHCK) were evaluated from November 2005 through March 2006. All admissions with injuries caused by Alpine skiing were reviewed. Those patients arriving from the local ski resort, all of whose injuries are referred to the institution for medical care separated out for consideration. Age, sex, type of injury, date of injury, Injury Severity Score, operations performed, and outcome (including mortality) were evaluated. In addition, resort utilization for the study period was obtained included in the evaluation.

RESULTS: For the 5-month period of the study overall approximately 15000 patients attended the HHCK. 3385 patients were admitted for injuries (22.56%), 1128 were related to Alpine skiing (33.32%). Skiers were (20 years; range, 4-44 years). 593 female patients were injured skiing. 16% of injured skiers sustained multiple injuries. 8,2% upper extremity injuries were found. 52% crucial ligament injuries occurred in skiers. Lower extremity injuries in general were common (78%). Central nervous system injuries, including head and spine were 0,2%. In addition, there was a 2% splenic injuries. 22 patients sustained abdominal or chest injuries and only two of these required operative intervention (two splenectomies). Other operative interventions were limited to extremity injuries, injuries of the spine, or placement of an intracranial pressure monitor. There were no fatalities recorded in this population. Spine injuries were recorded only in extremely young snowboarders and skiers out of control.

CONCLUSION: Alpine skiers are prone to injury. Abdominal and chest injuries in this population are generally amenable to wrong management of the sport. Prevention programs are best targeted at safe skiing practices, not skiing in poor conditions, use of helmets, and restraint skiing without guidance in very young children.

2. SNOWBOARDING INJURIES IN SNOW CENTER OF KALAVRITA

A. Arvanitis[1], D. Giannopoulos[2], M. Chronopoulou[1], S. Voulioti[2]

[1]General Practitioner trainee, "St. Andrew" General Hospital, Patras, Greece

[2]General Practitioner, Health Center of Varda, Greece

OBJECTIVE: Survey of snowboarders and study of their injuries, as well as analysis of the risk of injury considering the time spent on the snowboard.

MATERIALS AND METHODS: Of 216 patients of the Hospital – Health Center of Kalavrita in north – west Peloponnese participating in winter sport in the Snow Center of Kalavrita, 46 of those riding snowboards were asked to fill out questionnaires pertaining to demographics, their experience level, equipment, snowboard riding habits, and associated injuries.

RESULTS: A total of 38 snowboarders (82,60%), who spent approximately a total of 60 days snowboarding, during the December of 2006 until February 2007 filled out a questionnaire which could be evaluated. A total of 16 snowboarders had suffered a mean of 3.6 injuries per day of snowboarding, which required medical care; 38% of the injuries were moderate or severe. The most common injuries were to the wrist (19%), the hand (17%), and the head (7%). The rate of injury was especially high during the first half-day (roughly 2 -2,5 hours).
Use of wrist protection devices under the instructions of the physical education instructor, reduced injuries to the wrist up to 30% ($p = 0.048$).

CONCLUSION: Risk of snowboard related injury was highest in beginners. Through the use of wrist protection devices, the incidence of the most common injuries was dramatically reduced.

3. INJURIES TO WORLD CUP SKI AND SNOWBOARD ATHLETES

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INTRODUCTION: The International Ski Federation (FIS) has voiced concerns regarding injuries sustained by elite skiers and snowboarders. Unfortunately, little is known about the injury profile of skiers and snowboarders competing at the elite level. The injury risk in the various disciplines at the World Cup level is poorly documented and there is limited data to suggest how injuries may be prevented. With these questions in mind, the FIS Injury Surveillance System (FIS ISS) was established prior to the winter season 2006-07 by FIS in cooperation with the Oslo Sports Trauma Research Center.

AIM: The purpose of this study was to compare the injury risk and pattern between the different disciplines within FIS.

METHODS: Athletes from nine selected World Cup teams in each of the six disciplines of alpine skiing, freestyle skiing, snowboard, ski jumping, Nordic combined and cross country skiing were interviewed towards the end of the 2006-07 winter season at eight different events in Europe and the United States regarding injuries they had sustained during the season. They were asked questions regarding body part injured, injury severity (number of days out of training/competitions), a specific injury diagnosis as well as the circumstances for each injury. Coaches and/or physical therapists/physicians were interviewed regarding athletes on the team roster who did not participate in the season ending events due to injuries or other reasons.

RESULTS: A total of 296 injuries were recorded among the 902 athletes interviewed, 47% (n=139) in World Cup events (including official training and World Championships) and 28% (n=84) in other training activities on snow. There were a total of 217 (73%) time-loss injuries, where 84 (28%) lead to an absence of >28 days and 76 (26%) did not lead to any absence. Alpine, freestyle and snowboard accounted for 84 (28%), 49 (17%) and 100 (34%) of all injuries, respectively. The number of time-loss injures per 100 athletes was 28.8 in alpine, 26.8 in freestyle and 44.7 in snowboard, while the Nordic events had 26.3 injuries per 100 athletes per season in Nordic combined, 19.4 in ski jumping and 5.8 for cross country. Knee injury was the most common injury type with a total of 81 injuries (27%) followed by 36 injuries to the lower back (12%) and 31 head injuries (11%).

CONCLUSION: The injury frequency of elite ski and snowboard athletes is high, particularly in snowboard.

4. THE BEST METHOD TO REGISTER INJURIES AMONG WORLD CUP SKI- AND SNOWBOARDERS

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BACKGROUND: The International Ski Federation (FIS), in cooperation with the Oslo Sports Trauma Research Center, has established an injury recording system, the FIS Injury Surveillance System (FIS ISS), to monitor injuries to World Cup-athletes in skiing and snowboarding.

OBJECTIVE: The purpose of the current study was to compare three different methods to record injuries in this setting.

METHODS: Injury information regarding type, body part injured, severity and diagnosis was recorded for injuries suffered by World Cup athletes in alpine skiing, freestyle skiing, snowboard, ski jumping, Nordic combined and cross country skiing during the 2006-07 winter season. Three separate and completely independent recording systems have been carried out during this season, one prospective recording by the technical delegates (TD) from FIS, one prospective recording by the medical staff of six selected World Cup teams and one retrospective athlete interview at an event towards the end of the season with 623 athletes from the same six nations. For the retrospective interviews, coaches and/or physical therapists/physicians were interviewed regarding athletes on the team roster who were not present for the interview because of injuries or other reasons. The injury definition used for the FIS ISS is "all injuries that occur during official training or competition and require attention by medical personnel". Injuries occurring to athletes from the selected nations in World Cup events and World Championships (including official training) have been used to compare the different recording methods.

RESULTS: A total of 100 injuries to 623 World Cup athletes from the six selected nations were registered from World Cup events and World Championships during the 2006-07 winter season. Of these, 91% were registered through the retrospective athletes/coaches interviews, 47% through the prospective registration by the team medical staff and 27% through the prospective registration by the TDs. Only 20 injuries (20%) were captured by all three systems. A total of 64 time-loss injuries (leading to absence from training/competition for at least one day) were registered. The interviews captured 60 (94%) of these, the team medical staff 39 (61%) and the TDs reported 23 (36%) time-loss injuries, while 18 (28%) were registered in all three systems.

CONCLUSION: Retrospective interviews with athletes (or in their absence, coaches/physical therapists/physicians) regarding injuries during the last 6 months gives the most complete picture of injuries to World Cup-athletes in skiing and snowboarding.

5. A 16-YEAR STUDY OF ALPINE SKIING INJURIES FROM A SOUTHERN LAPLAND SKI RESORT IN SWEDEN

Lars-Gunnar Elmqvist MD, PhD

A prospective epidemiological study has been performed in a Swedish ski resort (Tärnaby/Hemavan) to evaluate alpine skiing injuries over time.

METHOD: All injured skiers during 1989-2005, consulting a physician within two days after injury were evaluated. A questionnaire was filled in by the patient and the physician.

RESULTS: There were a total of 3217 injured skiers; 1833 alpine skiers (AS), 1209 snowboarders (SB), 126 telemark (TM) and 47 injured snowblade skiers with a mean age of 22 years (19 years for SB and 22 AS). The overall female/male ratio was 41/59%; 45/55% AS and 36/64% SB. The injury rate was 1,1 per 1000 skier days for alpine skiers and 3 for snowboarders.
Beginners were less risk taking but had more falls and were injured more frequently than advanced skiers.
Injury was located to upper/lower extremity in 31/51% for AS and 56/18% for SB.
Knee was the most common injury location for both sexes in AS; female/male; 39/23% while SB mostly had lower arm injuries, female/male 40/34%.
Head/neck injury was more frequent in AS among males (14%) than females (9%). In SB the opposite males 13% versus 16% for females.
The use of helmet increased from 25 - 58% while head/neck injury rate decreased slightly. There were small changes over time for all parameters.

CONCLUSIONS: The injury rate was low and stable over time. Discipline, age, gender and skill determine frequency, location and type of injury. The most frequent single diagnosis was a knee injury Helmet usage increased, but injury rate for head/neck injury in general was not influenced. For injury prevention, helmets are recommended for all skiers and wrist guards for SB.

6. SKIING AND BOARDING INJURY RISK AND INJURY TYPES

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Skiing injuries may be divided into injury related factors, skier related factors, equipment related factors and slope related fractures.

INJURY RELATED FACTORS: The injury rate in Norwegian ski resorts has been about 1.5 injuries per 1000 skier/boarder days during the last decade, compared to about 2.5 injuries per 1000 skier/boarder days in France and U.S.A. The knee is the most common injuries site in alpine skiing accounting for about 25% of the injuries, whereas wrist injuries are most common in snowboarding accounting for about 30% of the injuries. Lower leg fracture has decreased with the development of modern skiing equipment whereas anterior cruciate ligament (ACL) injury has increased to 12-15% of the injuries in alpine skiing.

SKIER RELATED FACTORS: Gender has no significant influence on the general injury rate, but injured females have twice as many knee injuries and half as many shoulder injuries as males. Regarding age teenagers are more at risk to suffer a skiing injury than children and adult skiers. Skiing ability is the most important risk factor in skiing and beginners are three times more at risk to suffer a skiing injury than experts.

EQUIPMENT RELATED FACTORS: Too tight release bindings increase lower extremity injuries. The risk of lower leg fracture is presently relatively low in adult skiers and teenagers, accounting for about 4% of the injuries in contrast to children where lower leg fracture accounts for about 15% of the injuries. This is partly due to many children skiing on inferior skiing equipment. It is important to test the release function of the bindings and skiers who had not tested their bindings have twice the injury risk of those who have tested the bindings. The head injury risk is significantly lower for skiers using helmet compared to skiers without a helmet.

SLOPE RELATED FACTORS: Skiing is easier on well groom slopes and black spots on the slopes should be identified by plotting the injuries on a map to facilitate injury preventive measures.

CONCLUSION: Skiing is a relatively safe sports and the injury rate is only 1 to 2 injuries per 1000 skier days. This means that a skier spending a week skiing each year may ski for about 100 years before suffering a skiing injury. Snowboarders have twice the injury risk of alpine skiers. Alpine skiers suffer mainly knee injuries and snowboarders suffer wrist injuries. Children are still at risk for lower leg fractures in alpine skiing and they should have a well adjusted boot binding system.

7. THE IMPACT OF SNOW CONDITIONS ON INJURY SEVERITY AND INJURY FREQUENCIES IN WINTER SPORT PARTICIPANTS

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BACKGROUND: There is no evidence in literature on the influence of snow conditions and artificial snow on injury frequencies and injury severity. Data concerning injury severity, frequencies and injury patterns in winter sport participants is very inconsistent and no data about their changes during the last years is known.

HYPOTHESIS: Due to equipment development and demographic changes of winter sport population, variations in injury pattern and frequencies innately can be expected. Different snow conditions and the use of artificial snow with resulting denser snow conditions are suspected to change injury severities and frequencies. The aim of this study was to evaluate the influence of snow conditions on injury rates and injury severity.

STUDY DESIGN: Descriptive Epidemiology Study.

METHODS: We analyzed demographics of the injured winter sport population, evaluated frequency, injury patterns, severities of injuries, their changes over a six year period and analyzed the influence of snow conditions on these parameters.
18,367 ski-, snowboard- and tobogganing injuries were reviewed from 2001 to 2007.

RESULTS: Injured winter sport participants were predominantly male 60.8% ($p<0.001$), in the three sport disciplines. Skiers represented the oldest ($p<0.001$) group (male 35.3±17.7[2-85] years and females 34.1±16.7[2-84], with high rates of lower limb injuries 39%. Tobogganers even showed a higher percentage of 49.2% ($p<0.001$) of lower limb injuries than skiers, whereas snowboarders mostly injured upper extremities (44.7%). Injury frequencies were consistent in all years even in winters with statistically significant ($p=0.27$) scarcer snow conditions, but injury severity increased significantly in years with scarce snow conditions (ISS=3.6) in comparison with good snow conditions (ISS=4).

CONCLUSION: Injury frequencies and patterns were very consistent over the six year observation period. Scarce snow conditions contribute to a statistically significant increase in injury severity and contribute to a dramatic increase in severe head injuries with fatal outcome.

CLINICAL RELEVANCE: Understanding the impact of snow conditions and artificial snow on injury severity and injury patterns and the identification of clinical relevant injury patterns is important for the implication of preventic sports equipment. Further these investigations are inevitable in times were countries try to implement legislation to enforce the use of protective sports equipment.

8. A REVIEW OF RESEARCH LITERATURE RELATING TO AN ADJUSTABLE/RELEASABLE SNOWBOARD BINDING

J. SHEALY

This is a review paper on the merits of an Adjustable/Releasable (A/R) binding for snowboarding participants. The release function of alpine ski bindings is intended to address mid-shaft tibial bending and twisting injury mechanisms, and has proven to be quite effective in the mitigation of such injuries. To date, no manufacturer of A/R snowboard bindings has specifically enumerated the injury mitigation strategies associated with an A/R snowboard binding. Approximately relevant 30 papers are included in the review. The peer reviewed scientific literature indicates that snowboarding participants experience a lower rate of tibial shaft injury than is the case for skiers. This is true even though virtually all snowboarders utilize a non-releasable system and virtually all skiers utilize a system designed to release in a manner intended to reduce the likelihood of a tibial shaft injury. The incidence of ankle injury in snowboarders has decreased by approximately 75% since the mid 1980s; the remaining ankle injuries may be more related to ankle support issues and manner of landing than from a lack of a release mechanism. The presence or absence of an A/R binding does not appear to be related to the incidence of Non-Avalanche Related Snow Immersion Death events. If the intended injury mitigation strategy for an A/R snowboard binding is similar to that of the alpine ski binding, then there does not seem to be a significant problem to be addressed.

9. THE ROLE OF HELMETS IN INJURY MITIGATION IN SKIING AND SNOWBOARDING

J. SHEALY

We anticipate that by the time of this congress, we will have finished our extensive analysis that we began in 1993 into the role of helmets in the mitigation of head injury in skiing and snowboarding. Our general findings at this point are: If head injury is defined as any injury above the neck without regard to severity, then the use of a helmet is associated with a 30 to 40% overall reduction in head injury, but the greatest benefit is to the less serious head injury such as a scalp laceration, the benefit is dramatically less for the more serious injuries, and seems to be virtually non-existent for fatal injuries. The analysis looks into why this is so from an engineering perspective as well as from an environmental perspective. We examine helmet usage pattern differences between males and females, ability levels, as well as various age groups. The data include US national data for fatalities since the 1970s to present as well as more than 1,000 specific physician diagnosed head injuries at Sugarbush. The control data is from both the Sugarbush study as well as US National demographic studies. The analysis includes an engineering analysis of helmet design principles and materials in light of the environment in which helmets are used. This work provides a realistic evaluation of what a helmet can and cannot do in mitigating head injury in alpine sports.

10. KNEE INJURIES IN STATISTICS. A RETROSPECTIVE ANALYSIS OF PATIENTS FROM 1980-81 TILL 2000-01 IN PAS DE LA CASA-GRAU ROIG (ANDORRA)

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After realising that the knee is one of the most injured parts of the body in the Pas de la Casa-Grau Roig ski resort, we decided to make research in the archive of medical reports of our medical center from the season of 1980-81 until the season of 2000-01. The purpose of this study was to do a retrospective analysis to look for any epidemiological change involving this particular injure along the years.

There has been an increase in the number of ski injuries since 1980, probably caused by the same increase in the number of amateur skiers in our country and neighbour countries. In particular, knee injuries increased a lot in the 80s and it was not until the late 90s that the number rose up to the sum of one third of the global of the injuries. Surprisingly, the results showed that women are the most knee-injured skiers (1.6:1 ratio) although they are in fewer number than men when referring to number of amateurs. Globally speaking, the most injured group in women was the one including the age range from 16 to 25 years-old (2:1 ratio women/men).

By means of this study we have found that women are probably less sporty and less trained than men in recreative skiing. In addition, although it may sound obvious, the quadriceps muscle has less muscular mass in women than it has in men, just for genetical reasons, and this muscle is the most important one for the stability of the knee. Finally, we think that the most important way to reduce these particular injuries is the prevention itself.

11. MECHANISMS OF KNEE INJURIES IN SKIING

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EPIDEMIOLOGY: Knee injuries account for about 25% of all injuries in alpine skiing, about 12% in telemarking, and about 18% and 6% respectively in skiboarding and snowboarding. Female knees are about twice more at risk than male knees. Medial collateral ligament (MCL) injuries account for about 60% of the knee injuries in skiing, and of these are about 60% grade 1, 25% grade 2 and 15% grade 3 (total rupture).
Anterior cruciate ligament (ACL) injuries account for 12-15% of the injuries in alpine recreational skiers, but 30% of alpine and freestyle Word cup and Olympic racers have suffered ACL injuries and so have 50% of the 30 top ranked World cup racers compared to 25% for national level racers.

INJURY MECHANISM OF ACL INJURIES: Several injury mechanisms for ACL injuries have been described. These include abduction and external tibial rotation the phantom foot mechanism, boot induced anterior drawer, knee hyperextention, knee hyperflextion and possibly forceful quadriceps contraction. The most common mechanisms are the phantom foot mechanism and abduction and external tibial rotation. In racers also the boot induced anterior drawer is common.

PROPHYLACTIC MEASURE: Correctly adjusted released bindings has been reported to reduce the grade 1 and grade 2 MCL injuries, but so far ACL injuries do not seem to be related to unadjusted bindings. ACL awareness training has reduced ACL injuries by 60% among American ski patrollers.

12. ACL INJURED AND UNINJURED TOP LEVEL ALPINE SKIERS - A DESCRIPTIVE COMPARATIVE STUDY ON POSSIBLE INTRINSIC AND EXTRINSIC RISK FACTORS

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BACKGROUND: Alpine skiing is a very popular sport for children and adolescents. However, it is not without risks of injuries. The majority of injuries in alpine skiing are knee sprains and in particular anterior cruciate ligament (ACL) injuries, which is the most serious one. An ACL injury has consequences for the athlete in terms of lost time from sports and a great risk for osteoarthritis in the future.

AIM OF STUDY: The aim of the present study was to compare uninjured and ACL injured alpine skiers from a ski high school in Sweden, and to describe possible risk factors for ACL injuries.

MATERIAL AND METHODS: All 22 alpine skiers (11 males, 11 females) from Gällivare Ski high school at the northern part of Sweden were studied. Prior to the ski season they were clinically examined and then prospectively followed in terms of ACL injuries during one ski season. Except for the clinical examination they also answered a questionnaire about demographic and ski-related data.

The clinical examination included control of general joint laxity, knee alignment, leg length discrepancy, varus-valgus knee laxity and anterior knee laxity. Range of motion/muscle flexibility was measured in ankle dorsiflexion, hip flexion with knee extended in supine position, hip extended with knee flexion in supine position, and knee flexion with hip extended in prone position. Three different functional performance hop tests were also performed: one-leg hop test for distance, side-hop test and square-hop test.

RESULTS: Five (out of 22) skiers sustained an ACL injury. In four skiers the injury occurred in the technical disciplines, and one skier sustained the ACL injury in the speed disciplines.

Four out of the five injured skiers sustained their ACL injury at the end of the ski season.

The ACL injured skiers showed greater side-to-side differences in all range of motion/muscle flexibility variables except for ankle dorsiflexion compared to the non-injured skiers.

There were no differences between injured and uninjured skiers regarding the other studied variables.

CONCLUSION: A higher number of ACL injuries occurred during the technical disciplines. The skiers that sustained ACL injuries showed a greater side-to-side difference in most of the range of motion/muscle flexibility variables.

13. ASSESSMENT OF FUNCTIONAL OUTCOME AFTER ACL RECONSTRUCTION USING BPTB AND QUADRUPLED ST/G TENDON AUTOGRAFTS: APPLICATION OF THE NON LINEAR MEASURE OF APEN

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OBJECTIVE: To investigate the effectiveness of BPTB and ST/G autografts in restoring gait patterns after ACL reconstruction by evaluating stride-to-stride variability during walking. We also examined the clinical outcome of ACL reconstruction using these two autografts.

DESIGN: Prospective cohort study.

SETTING: Patients were evaluated in a gait analysis laboratory located in an outpatient orthopaedic sports medicine clinic.

PARTICIPANTS: Seven ACL reconstructed patients using BPTB graft, six ACL reconstructed patients using quadrupled ST/G graft and twelve healthy controls.

INTERVENTION: All the ACL-deficient patients underwent a unilateral ACL reconstruction.

MAIN OUTCOME MEASUREMENTS: The Lysholm score, the Tegner activity level and the IKDC score were used to assess clinical outcome. A six-camera optoelectronic system was used to capture knee flexion-extension time series while subjects walked on a treadmill. Stride-to-stride variability was evaluated using the nonlinear measure Approximate Entropy estimated from the knee flexion-extension time series.

RESULTS: No significant differences for the clinical outcome were found between the BPTB and the ST/G group. However, both reconstructed groups exhibited higher ApEn values than the control knee, although, significant differences were found only between the ST/G and control group.

CONCLUSIONS: Approximately two years after ACL reconstruction the BPTB reconstructed knee seems to exhibit walking patterns similar to the control while the ST/G reconstructed seems to move along more variable patterns. However, more studies are required to establish this result and indicate the importance of using such variability measures in orthopaedics.

14. THE IMPACT OF A REHABILITATION PROTOCOL APPLIED TO A YOUNG FREESTYLE SKIER FOLLOWING ACL RECONSTRUCTION

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INTRODUCTION: The purpose of this study is to outline an ACL rehabilitation program applied to a young freestyle skier. Although functional evaluation of involved vs. uninvolved limb is usually applied in clinical settings, we decided to assess long-term responses of the disabled limb to functional tests. Periodical monitoring of functional ability likely provides useful information to facilitate individual re-engagement in sport-related activities.

METHODS: The proposed rehabilitation protocol was applied to a single subject (19 years, 74 kg and 1.83 m) and consisted in exercises concerning muscular, ROM and proprioceptive recovery. Knee extensor-flexors peak torque (PT) and total work (W), balancing ability and jump height were respectively evaluated using an isokinetic device (Biodex System 3, Shirley, NY, US) an electronic balance board (Delos, TO, Italy) and an optic fibre device (Optojump, Microgate, BZ, Italy). Cyclic isokinetic contractions were exerted at three angular speeds (240, 120 and 60°s^{-1}), each divided into three trials according to the number of repetitions (5, 10 and 15) with a rest time of 60s. Balance ability was assessed using the frequency band encompassing 80% (F80) of total energy of board sways spectrum, which was estimated for three standing trials on single leg. Welch method was applied to estimate power spectrum dividing board sway time series (30s) into five 50% overlapped segments (10s), providing a spectral resolution of 1.0 Hz (Shiavi, 1999). Jump height was evaluated as the average of two jump trials performed with counter-movement. Functional tests were applied in two different occasions; 1) three months following ACL reconstruction, just after carrying out the rehab program and 2) four years after surgery.

RESULTS: Concerning the rehab program follow-up the patient was once again engaged in ski activities after circa 90 days from surgery and a rigorous orthopaedic control. Nowadays he attends to a graduate course in medicine and often participates in ski competitions, football games and heavy resistance training. Functional assessments revealed higher values for PT, W, jump height and a decrease of sway frequencies for body stabilization with time (Table 1), even without any therapeutic interventions.

DISCUSSION: Primarily, we would like to stress that the observed results should not be generalized to other subjects. In this particular case, the rehab protocol provided satisfactory results even after a short time following ACL reconstruction. In spite of a specific rehab program the improvement of muscle force, jump height and balancing ability, as observed with the functional assessment, suggests long-term adaptations to ACL reconstruction. Objective assessment of functional abilities are unaffected by misleading interpretations of the experimenter, providing reliable and useful information to monitor a patient recovery.

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Table 1: Mean values for knee extensor-flexors peak torque (PT), total work (W), jump height (Height) and 80% frequency band of sway (F80), estimated for a single subject just after an ACL reconstruction surgery and four years after. PT and W are presented for different velocities of isokinetic contractions (240, 120 and 60°s-1). All values reported correspond to the affected limb.

	240° s^{-1}		120° s^{-1}		60° s^{-1}		Height (cm)	F80 (Hz)
	PT(Nm)	W(kJ)	PT(Nm)	W(kJ)	PT(Nm)	W(kJ)		
Three months								
Extension	111.4	1.38	114.5	1.19	144.2	0.73	20.8	4.0
Flexion	91.0	1.14	84.8	0.93	105.3	0.57		
Four years								
Extension	149.7	2.31	193.6	1.84	218.3	0.10	24.8	3.2
Flexion	91.3	1.56	110.3	1.30	119.4	0.65		

15. MUSCLE STRENGTH EVALUATION OF THE LOWER LIMBS IN AMATEUR ATHLETES WITH THE USE OF ISOKINETIC DYNAMOMETER

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PURPOSE: Isokinetic Dynamometer is a valuable tool for the evaluation of the muscle strength in athletes. Isokinetic muscle evaluation is the choice of most of the experts because of its safety and precision. According to the literature, differences in the muscle strength of quadriceps and hamstrings between the two sides as well as asymmetry of those muscles in the same leg predispose to injuries. The purpose of this paper is to evaluate muscle strength of the lower limbs in amateur athletes, in order to plan a study for the use of the isokinetic dynamometer as a tool for prevention of lower limb injuries in the athletes.

MATERIAL - METHODS: We tested 65 amateur athletes (31 female, 34 male, mean age 17 years), having Tegner Activity Score 6,6. We have used the Biodex Isokinetic Dynamometer with which we tested flexion and extension of the knee joint in 60°/sec in both legs. We used in our study the following values, which compared with the normal values suggested in the literature:

1: The difference in peak torque (index of muscle strength) in flexion and extension of the knee joint between the right and the left leg.

2: The ratio of the peak torque of agonists to the antagonists for each limb.

RESULTS: From our study we found that 53% (35) of the athletes were below the normal limits for the above values.

CONCLUSION: It seems that many athletes have to emphasize on strengthening the hamstring muscle groups in order to improve the muscle symmetry of the knee joint and probable avoid many future athletic injuries. We definitely need further study in order to evaluate the usefulness of the isokinetic dynamometer as a tool of prevention of athletic injuries of the lower limbs.

16. CARDIOVASCULAR STRESS ASSOCIATED WITH ISOKINETIC TRAINING; CONCENTRIC/ECCENTRIC, ANGULAR VELOCITY, SHOULDER/KNEE

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INTRODUCTION: Isokinetic exercise is effective strengthening method to generate maximal power within full range of motion with steady angular velocity. Overend has been reported that eccentric exercise has less cardiovascular stress than concentric exercise because of eccentric movements require less muscle activation, reduction of the intramuscular forces results in decrease of blood pressure. We want to compare extent of the cardiovascular stress from eccentric and concentric exercise that executed in isokinetic exercise through as perceived maximal effort and we compare the difference from concentric exercise to angular velocity also the difference according to the exercise parts.

METHODS: In this study, 12 adults without cardiopulmonary problem, shoulder and/or knee disease and trauma history. (average age = 31.1±8.2, male/female = 7/5) were enrolled. They did dominant shoulder and knee flexion/extension isokinetic exercise at 60°/sec, 180°/sec of concentric exercise and 60°/sec of eccentric mode using Con-Trex® (CMV AG, Duebendorf, Switzerland). Each exercise which has 30 seconds break per 8 times of sequence proceed with perceived maximal effort, repeated 3 sets, had enough break about 3 minutes per each check up. We measured heart rate (HR), systolic blood pressure (SBP), diastolic pressure (DBP) and rate-pressure product (RPP) with before and after exercise and then we compared them using ANOVA test.. Statistical significance was set at $P<0.05$.

RESULTS: At base/Concentric 60/concentric 180/eccentric 60 exercise of knee and shoulder, the mean value of HR (beats/minute) were 81.8±16.1/138.5±27.7/138.5±21.5/133.6±25.9 and 81.0±8.3/142.2±28.7/147.2±27.1/133.0±21.4 and the mean value of SBP(mmHg) were 122.1±8.4//149.6±21.7/139.2±21.9 and 118.3±8.6/146.7±16.7/144.1±14.0/146.3±18.5. Mean values for heart rate after all exercises were increased than the baseline. Eccentric exercise of 60°/sec elicited significantly lower than concentric exercise of 180°/sec. But it didn't not show the difference between knee and shoulder, and different angular velocity of concentric exercise. ($P>0.05$) Mean values for SBP after all exercises were increased than the baseline. But it didn't show the differences between concentric and eccentric, knee and shoulder, and different angular velocity of concentric exercise. ($P>0.05$)

CONCLUSION: Among isokinetic exercises, eccentric exercise decreased the cardiovascular stress than concentric exercise. But there was no cardiovascular stress difference according to the angular velocity and exercised limbs. And further study will be needed to compare the cardiovascular stress difference at actual training intensity (50% of peak tork).

17. ISOKINETIC MUSCLE EVALUATION OF THE LOWER LIMBS IN YOUNG PATIENTS SUFFERING FROM ANTERIOR KNEE PAIN

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PURPOSE: Historically, patients with the complaint of pain around the extensor knee mechanism but without signs and symptoms of patellofemoral instability have been lumped together into a diagnostic category known by various labels, such as Chondromalacia Patella, Excessive Lateral Pressure Syndrome, Patelofemoral Pain Syndrome. The purpose of our study is, by evaluating the muscle strength of the lower limbs in patients suffering from the above mentioned – and many times difficult to treat condition, to add the findings in the current literature.

MATERIAL: We used the Biodex Isokinetic Dynamometer with which we tested flexion and extension of the knee joint in 60°/sec in both legs. The parameter used was the ratio of the peak torque of agonists to the antagonists (AGON/ANTAGON ratio) for each limb. The first group (A) of our study consisted of 15 patients (Mean Age 23.1 y), suffering from chronic anterior knee pain without any history of major knee injury, and the second croup (B) was the control Group, consisting of 33 healthy subjects (Mean Age 20.2 y).

RESULTS: In Group B the difference of the AGON/ANTAGON ratio between the right and the left leg was **5,58% (p=0,08)**, values which are not statistical significant. In Group A the difference between the healthy and the involved leg was **15,07% (p=0,013)**, which is a statistical significant difference.

CONCLUSION: Our results indicate that there is a definite and statistical significant muscle imbalance between the healthy and the involved leg in patients suffering from anterior knee pain. We cannot conclude if this imbalance is the cause or the result of the disease. Further research is needed in this area.
Nevertheless, we think that the Sports Medicine practitioner dealing with athletes with anterior knee pain should pay a lot of attention in the symmetric strengthening of the knee extensor and flexor muscle group.

18. BACKWARD WALKING AFFECTS STRIDE-TO-STRIDE VARIABILITY

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BACKGROUND: Stride-to-stride variability is defined as the temporal variations in movement patterns from one stride to the next. Through nonlinear methodology it has been proven that stride-to-stride variability under healthy conditions exhibits a chaotic structure which renders the neuromuscular system adaptable to environmental changes, whereas aging and several neurologic and orthopaedic conditions may have an effect on stride-to-stride variability and thus make the system less adaptable to perturbations. In recent years there has been a growing interest in the use of backward walking (BW) and running for training and rehabilitation purposes especially after ACL reconstruction, as the ACL rupture accounts for a high rate of sports injuries especially of soccer and skiing injuries. Although have been studied from a biomechanical, cardiovascular, and metabolic perspective, nothing is known about variability that BW displays.

PURPOSE: The purpose of the present study was to investigate whether the reversal of the walking direction from forwards to backwards has an effect on the stride-to-stride variability. We hypothesized that backward walking would display increased variability when compared to forward walking.

MATERIALS AND METHODS: 9 healthy male subjects walked on a motorized treadmill initially forwards and then backwards at their self-selected pace while hip, knee, and ankle kinematic data were collected (50Hz) with an eight-camera optoelectronic system. A nonlinear measure, the largest Lyapunov exponent (LyE) was calculated from the resulted hip, knee, and ankle sagittal angular displacement (flexion/extension) time series for both walking modes. Larger LyE values signify increased variability and increased sensitivity to initial conditions. Dependent t-tests were used for the comparison of LyE means of forward and backward walking for each of the three main joints of lower limb (i.e. hip, knee, and ankle). Differences were regarded as significant at $p<0,05$.

RESULTS: BW displayed increased variability for the three joints. LyE values for hip were 0,122 and 0,198 for FW and BW correspondingly. LyE values for knee were 0,12 and 0,184 and for ankle 0,161 and 0,25 for FW and BW correspondingly. Results were statistical significant.

DISCUSSION: ACL injuries account for a high rate of the skiing injuries. BW has been used as component of rehabilitation programs after ACL reconstruction. Research indicates that BW increases the strength and power of the quadriceps muscle and that it is associated with less biomechanical strain on the knee joint than is FW. Our results revealed that during BW the joints of lower extremity exhibit a greater amount of variability when compared with FW. Thus, hip, knee, and ankle display decreased adaptability to environmental changes and this may render these joints susceptible to injuries. Perhaps this could be more severe for ACL reconstructed patients when performing BW during their rehabilitation period. Moreover, such an injury may happen in highly competitive team sports such as soccer and basketball where the athletes often perform BW activities.

CONCLUSION: BW displays increased stride-to-stride variability for the three main joints of lower extremity and this renders these joints more prone to injury. Although BW may seen a reasonable component of rehabilitation programs after ACL reconstruction, before we use it for this purpose we need to know all aspects of this walking mode, including stride-to-stride variability.

19. RADIOGICAL IMAGE OF FORMER SKIERS LOWER EXTREMITIES

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Elite athletes' sports activities cause increased loads in their joints. The aim of our study was to investigate the incidence of radiological signs of osteoarthritis of the lower extremities in former elite skiers.

We studied the radiological image of lower extremities joints in 38 males former skiers mean age 53.5 years (SD±11.31) who participated in national championships and in international games with the national team. The control group was 163 males mean age 50.67 years (SD±10.04) who didn't have sport professional activity and they were completely healthy when they had their military obligation. The participants in the study did not have diagnosed or/and operated for fracture, menicsal or ligament injury. Radiographs of lower limb joints were taken in standing position and classified according to Kellgren and Lawrence's scale.

After adjusting the age, height, weight and body mass index (BMI), we made statistical analysis (student's t-test, z-test, CI=95%, $p<0.05$) and recorded an increase of incidence of radiological findings of osteoarthritis (mostly osteophytes and subchondral sclerosis) in former skiers compared with the general population (34.2% and 23.9% respectively, $p<0.05$). Interestingly, these x-rays arthritic signs were not followed by clinical manifestations.

There are many studies in the literature about the question if sport activity and especially in high level is a predisposal factor for osteoarthritis. We found that in former elite athletes there is high prevalence of radiological image of OA. It could be assumed that increased radiographic signs are premature indication of the clinical syndrome of OA.

20. BONE MARROW OEDEMA OF THE KNEE IN SKIING TRAUMA

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INTRODUCTION: Bone Marrow Oedema (BMO) is a syndrome encountered in the adult population, with the knee being the most common site of the lesion. It is usually diagnosed by MRI scan. The aetiology and the pathophysiology of the syndrome remain unknown. Traumatic Bone Marrow Oedema is of known aetiology, appears in MRI scan and cannot be discriminated by the pathologist in the primary stages.

MATERIAL AND METHOD: During the period from January 2000 till June 2006, we have treated 176 patients with BMO. 36 of those were medium level or "weekend" athletes that have sustained a knee injury during sport activities. The athletes ranged from 17 to 42 years of age. 10 of those (8 male, 2 female) sustained skiing or snowboard related injuries. In 6 patients, BMO involved the lateral femoral condyle, in 2 patients the medial femoral condyle, while in 2 patients the pathology involved both the lateral femoral condyle and the tibial plateau. The accompanying injuries included meniscal tears, ligament ruptures and osteochondral fractures. In 2 of the cases, BMO was the only pathology. In 7 of the 10 cases the injury was located in the right knee.

RESULTS: In follow-up (6 months – 2 years), the BMO lesions were found of the same or smaller size (according to the Koshino & Lotke criteria) in 7 cases, while BMO resolved spontaneously in 3 cases. The ACL rupture, which was the commonest accompanying injury, appears to be connected to the high frequency of BMO presentation in the lateral femoral condyle. The high incidence of BMO in the right knee is a result of the mechanism of injury, which was most commonly a fall on the right knee in valgus - external rotation position. None of the patients developed osteonecrosis or early arthritis.

CONCLUSION: Further research is needed to determine the mechanism that causes traumatic BMO in the cases with no accompanying injuries. Moreover, it is not clear whether traumatic BMO is connected to knee pain or early arthritis in the long term. The role of surgical (drilling etc.) or conservative treatment (Iloprost), is still under dispute. It is however certain, that restriction of weight-bearing has excellent results in terms of pain. The patient should refrain from athletic activities until clinical and MRI findings allow it.

21. CORRECTION OF VARUS KNEES IN PATIENTS WITH AND WITHOUT ACL BY OPENING WEDGE OSTEOTOMY

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INTRODUCTION: The operational technique for opening wedge osteotomies has been simplified by the use of the Puddu-plate. This study presents results after use of Puddu-plates on proximal tibial osteotomies.

METHODS: 50 proximal tibial osteotomies have been preformed with opening wedge technique due to knee osteoarthritis with varus malalignment in the period 2000-2006. The knee osteoarthritis was mainly due to a previous meniscal extirpation. 16 patients had an additional rupture of ACL. The mean age of the patients with intact ACL was 48 years (34-64 years), and 44 years (31-58 years) for patients with additional ACL injury. The patients had a mean tibiofemoral varus angle of 1° (7° varus - 3° valgus). The osteotomy was fixed with a Puddu-plate securing the planned angular correction, and the osteotomy cleft was filled by autogenous pelvic bone. The mean follow-up time was 34 months (12-73 months).

RESULTS: The width of the osteotomy cleft was determined by the tooth of the implant. The mean width of the tooth was 8.5 mm (5-12.5 mm), and the mean angular correction measured on pre- and postoperative radiographs was 8.0° (5-12°). The osteotomy cleft healed after a mean of 12 weeks (7-18 weeks). One patient suffered venous thrombosis of the leg, two a postoperative wound infection and one an osteosynthetic failure. The knee injury and osteoarthritis outcome score (KOOS) increased significantly during the observation period. A score of 100 means no complains. For pain the mean preoperative score was 51 and the score at follow-up was 83. The corresponding scores for symptoms were 54 and 81, for activity of daily life (ADL) 62 and 90, for sport and recreation 26 and 61 and for quality of life 30 and 65 ($P<0.001$). Patients with additional ACL injury had similar postoperative KOOS as patients without ACL injury and so far only 2 of the 16 ACL injured patients have had additional ACL reconstruction.

CONCLUSION: The results after opening wedge osteotomy using the Puddu-plate show improvement during the first 2 years. The operational technique is simpler compared to previous methods, and the degree of angular correction is accurate depending on the width of the tooth of the implant which in mm corresponds relatively well with the degrees of angular correction.

22. ANTERIOR-PROCESS NONUNION OF THE CALCANEUS IN A SNOWBOARDER

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INTRODUCTION: The anterior process of the calcaneus is a saddle-shaped promontory of varied length and breadth which articulates inferiorly with the cuboid. Inversion and plantar flexion or equinovarus injuries, very frequent in snowboarders, are the most common mechanism of fracture. The anterior-process nonunion of the calcaneus is a complication stems from an anterior-process fracture of the calcaneus misdiagnosed and so mistreated. This paper shows our surgical technique to restore calcaneocuboidal anatomy.

METHODS: She is a woman, 26 years old who suffered a foot injury doing snowboard. She had tenderness located anteroinferior to talofibular ligament and inversion and adduction stress painful. A hindpart foot approach was used to reach calcaneocuboidal joint. Nonunion debridment was made and stabilized with a cannulated compression screw.

RESULTS: Three months after surgery, the pacient showed no tenderness, no discomfort on weight-bearing and radiological bone consolidation.

CONCLUSIONS: This case shows a very easy and reliable surgical technique to heal the Anterior-Process nonunion of the Calcaneus restoring the calcaneo-cuboidal joint.

23. YOUNG ELITE CROSS-COUNTRY SKIERS AND LOW BACK PAIN – A 5 YEARS STUDY

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BACKGROUND: Cross-country skiers at a top level, who train several hours daily are at risk for overuse injuries. Within the last two decades, there have been several reports of increased low back pain in young cross-country skiers compared to age-matched non-skiers.

OBJECTIVES: To evaluate possible changes in spinal curvature over a period of five years of an elite cross-country skiing squad and to study whether there are any differences in this respect between individuals who report low back pain and those how do not.

PARTICIPANTS: Fifteen young cross-country skiers (M=13.6±0.9) participated voluntarily throughout the entire study period.

MAIN OUTCOME MEASURES: Debrunner's kyphometer was used for measuring the difference between thoracic kyphosis and lumbar lordosis of the spine. All subjects also answered a questionnaire including questions about ski related low back pain, the amount of ski training and participation in other sports.

RESULTS: The results thus comprise data from fifteen skiers (M=18.5±0.9 years). The relationship between thoracic kyphosis and lumbar lordosis increased from 3.5° to 13.1°, respectively (p=0.0001). Seven out of fifteen elite cross-country skiers reported low back pain at the five year examination. At the five year follow-up skiers with low back pain showed significantly higher relationship between thoracic kyphosis and lumbar lordosis than did those skiers without low back pain, 18.2 and 10.5, respectively (p=0.035). Seven out of eight elite cross-country skiers without low back pain were involved in other sports than cross-country skiing (p=0.005).

CONCLUSIONS: Based on these results our advice is that adolescent cross-country skiers also should participate in other physical activities besides cross-country skiing.

24. THE EFFECT OF PRE-SEASON DANCE TRAINING ON PHYSICAL INDICES AND BACK PAIN IN ELITE| CROSS-COUNTRY SKIERS: A PROSPECTIVE CONTROLLED INTERVENTION STUDY

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BACKGROUND: In order to reach elite level, many sports require training with high intensity and high loads, often starting already at young age. In some sports the athletes are subjected to considerable forces, due to rapid and forceful movements or external weights, which might lead to an asymmetric load on the body. Lately, dance training has become a subject of interest in different sporting activities. Dance training is aimed to give a more all-round type of body exercise in order to balance the sport specific training that characterises sports at elite levels.

OBJECTIVES: The aim of the present investigation was to evaluate the effect of pre-season dance training on joint mobility and muscle flexibility of the spine, hip and ankle and on speed and agility in top level cross-country skiers. Another aim was to determine whether pre-season dance training could reduce the number of skiers with ski related back pain.

METHODS: 26 skiers participated (mean (SD) age, 19 (3.9) years). An intervention group (n=16) had 12 weeks of dance training; a control group (n=10) did not dance; otherwise both groups followed a similar pre-season physical training programme. Joint mobility and muscle flexibility of the spine, hip, and ankle were measured. Two sports related functional tests (slalom and hurdle) were also done. All measurements/tests were carried out before and after the dance period.

RESULTS: Four (of six) subjects from the intervention group who initially complained of ski related back pain did not report back pain after the dance training; the three subjects with back pain from the control group were unchanged. At study onset the intervention group had a slightly impaired range of motion in the spine compared with the control group. After dance training, there was a better relation between kyphosis of the thoracic spine and lordosis of the lumbar spine, and a 7.1° increase in hip flexion with the knee extended ($p=0.02$). In the control group hip extension decreased by 0.08 m on average ($p=0.01$). No positive effects of dance training on sports related functional tests were observed.

CONCLUSIONS: Preseason dance training improved the range of hip motion and joint mobility and flexibility of the spine. These improvements might explain the reduction in ski related back pain in the intervention group.

25. UPPER LIMB INJURY TYPES IN SKIERS AND SNOWBOARDERS IN GREECE

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BACKGROUND: In recent years winter sports have become very popular in Greece and many skiers and snowboarders get injured on the slopes.

AIM: To examine the incidence and patterns of upper limb injuries in Greek ski resorts.

METHODS: In a prospective control study, all the injuries occurring in two major ski resorts during the 2004-2005 winter season were recorded. A total of 587 injured skiers and snowboarders were recorded in a multivariate protocol. As a control group, 465 uninjured people randomly were questioned directly on the slopes and statistical analysis was followed.

RESULTS: The overall injury rate was 2.02 upper limbs Injuries per Thousand Skier Days (IPTSD). The possibility to have an upper limb trauma during snowboarding is much greater than skiing (IPTSD for snowboard is 3.01 but only 1.65 for skiing). Just 27.3% of injured skiers, but 49.3% of injured snowboarders experienced an upper limb trauma. Shoulder trauma experienced 8.6% of injured skiers and 13.3% of injured snowboarders and the most frequent type of shoulder injury was dislocation (30.3% for skiers, 52.6% for snowboarders). Wrist and forearm injuries had statistically significant differences between skiers and snowboarders (6.8% vs. 20%). The incidence of wrist fracture was 22.2% for skiers but 37.5% for snowboarders. The so called "skier's thumb" was detected at 50% of thumb injuries in snowboarders and 18.8% in skiers. Shoulder and elbow injuries had statistically significant differences between males and females skiers. The level of upper limb injured skiers and snowboarders was mainly intermediate (54.5% and 55.5% respectively).

DISCUSSION/CONCLUSION: Snowboarding is much more dangerous for an upper limb injury than skiing. The injury incidence and patterns are different among skiing and snowboarding and effective measures and protective means should be applied to eliminate these injuries.

26. ARTHROSCOPIC REPAIR OF AN ISOLATED TYPE II SLAP LESION IN YOUNG ATHLETES: EARLY RESULTS

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AIM: To evaluate the clinical outcome of the arthroscopic repair of an isolated type II slap lesion through absorbable and metallic anchors.

PATIENTS - METHODS: 13 young athletes suffered from isolated type II slap lesion were managed arthroscopically. Cases with concomitant rotator cuff disease and instability were excluded. All the patients were assessed with the ROWE score for stability, pain and range of movement 9 months to 2 years postoperatively. The sports activities recovery level was also assessed

Surgery technique: Through two or three portals one posterior and two anterior the LBH was reattached to the glenoid using:

1. A metallic anchor and double suture or
2. Two absorbable anchors anterior and posterior to the LBH respectively

RESULTS: 10 patients had full sports activities recovery. 3 patients are currently in a high level of roadwork, 9 months after the operation. Such patients underwent an operative repair immediately after the diagnosis had been made, seem to have a superior clinical result.

CONCLUSION: Reattachment with metallic anchor and double suture, as well as with two absorbable anchors have indicated relatively high success rate.

27. INJURIES IN SKIERS AND SNOWBOARDERS AMONG CHILDREN AND YOUTH. CASE CONTROL STUDY ON CHIRPP DATABASE

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OBJECTIVES: Alpine skiing and snowboarding are popular sport with significant risk of injuries. Each year in the United States, an estimated 13 million people participate in recreational skiing or snowboarding activities, accounting for about 57 million visits to ski areas. Many studies of ski or snowboard injuries have not considered risk factors for injuries to specific body regions. We studied the information and data pertinent to injured children (4-14 years) and youth (14-18 years) that was available on CHIRPP (Canadian Hospital Injury Reporting and Prevention Program) database.

METHODS: We analyzed 20,615 subjects from 1990 to 2005. Our study group was composed by 11,050 skiers and by 9,565 snowboarders.

RESULTS: We found all injuries among skiers were distributed in the following manner: 1992 knee (18%); 1625 lower leg (15%); 711 forearm (6%). Snowboarding injuries were found prevalently in the forearm (32%) and in the wrist (21%) and only 5% of knee injuries.

CONCLUSIONS: We found the highest rates of injury among the youngest group. Snowboarders had more injuries of the upper extremities whereas skiers were more likely to injure their lower extremities. Males were more at risk for head and neck injuries, whereas females had a greater rate of injuries to the lower extremities.
Significant protective attributes were found for helmet use especially with regards to spinal injuries within our study group. This data could be very important in helping to develop new strategies in research and new policies in the management of injury prevention.

28. SNOW SPORTS INJURIES IN CHILDREN, ARE THERE SIGNIFICANT DIFFERENCES BETWEEN RESIDENTS AND NON RESIDENTS YOUNG USERS OF THE ANDORRA SKI RESORTS?

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All the epidemiologic works on snowsports injuries show significant differences in several aspects regarding the age of the slopes users.
Considering that in Andorra all childs from 6 to 16 years are suposed to go to the winter sports with their schools, we were curious to see if there were significant differences in the rate of accidents, and other aspects, between andorran and visitors. For this we analized the Andorra ski accident data base for the 2006-2007 season, resulting from the data collection of the ski patrols, the ski resorts medical centers and the Andorra hospital.

29. A COMPARATIVE STUDY OF SKI AND SNOWBOARD INJURIES

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Since ski season 1995 we have documented 26,000 ski injuries and 4,000 snowboard injuries. During this time frame the number of visitors in our ski resort totals 7.500.000. Gender distribution showed that in snowboard males were injured in 72% of the time compared to females, while in downhill ski males accounted for 53% of the time. Age distribution demonstrated that snowboarders were younger in comparison to skiers (mean age for snowboarders was 25 years old compared to 35 years old for skiers).

According to anatomy, alpine ski injuries occurred equally in the upper and lower extremities, however upper extremity injuries in snowboarding showed to be more common compared to lower extremities.
Knee injuries represented 34% of the total alpine ski injuries while 19% in snowboarding accidents. Excluding knee, wrist, shoulder and thumb injuries, snowboarding incidents showed a larger variability of possible diagnosis compared to alpine ski (75% per snowboard compared to 40% for skiers).

The ACL injury was the most common injury among skiers while wrist and forearm fractures were more frequently seen in snowboarders. Lower spine fractures were equally observed in both skiers and snowboarders.

When speaking of collisions snowboarders are most likely to collide against an object (such as tree, rock, pole etc). While skiers most commonly collide with other skiers.

During this period of 12 consecutive winter seasons we have observed that the frequency of accidents among snowboarders is double in comparison.

30. MODERN DEVELOPMENT IN MANAGEMENT OF SPORTS INJURIES

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INTRODUCTION: Sports injuries are naturally multiple and so they request an individual therapy management. Especially in the rehab process of high level athletes the time to come back to training and competition is always too short. To be able to bring the best efficiency in the rehabilitation process it is necessary to offer a special adapted sport specific rehabilitation process. It is a process, which often lasts a period of weeks, sometime of months. We are trying to keep close in touch with the athlete until the rehab process is finished. At the end of this process the athlete should be integrated again in his common training programme.

THE REHABILITATION PROCESS: The sport specific rehabilitation process is parted in 3 phases:
Phase I - Acute Phase, Phase II - Mobilisation Phase, Phase III Stabilisation Phase

In Phase I the patient is in the clinic or it is managed that he is seen every day by his physician. In Phase II we try to keep the patient in a rehab centre, so he is able to work daily with his therapist and he can be three to four times per week controlled by the physician. In Phase III the athlete is recommended to follow the special developed rehab plan and partially he works with the trainer in his common training environment evaluated and treated by his physician every two weeks.

The following three aspects in this process should be in optimum harmony with each other:

1) The injured structure of the body should be given specific treatment.
2) Attention should be given to the position of the injured anatomic structure in the chain of motion, pertaining to the specific type of sport. Moreover, regulation of motion and the sensomotoric system should be given attention.
3) It should be ensured, that the athlete's stamina is not impaired, especially in terms of strength, endurance and speed. A training programme specifically designed to maintain the athlete's stamina should be pursued as far as possible, even the athlete is affected by the injury.

ACUTE PHASE: Main goals in this Phase are: Psychological evaluation of the injury. Pain therapy (medication, cryotherapy, TENS, positioning), Lymphmassage, Isometrics, Electrostimulation, Gait training, Ultrasound, Acupuncture

MOBILISATION PHASE: Main goals in this Phase are: Pain management, Lymphmassage, Laser, Reflex-therapy, Massage, Cryotherapy, Magnetic field therapy, Acupuncture, Hydrotherapy, PNF-techniques, Manual medicine, Gait training, Medical training therapy.

STABILISATION PHASE: Main goals in this Phase are: Increase of intensity and duration of above mentioned therapy modalities. Medical training therapy which is based on the principles of motor and training science which are integrated in the rehabilitation process. The athlete knows how to work with his special to him adapted rehab programme and he is back again in his before the injury happened, normally used common environment. He is participating the training with the team but working on his special rehab programme.

CONCLUSION: The treatment of complex mobility disorders, so many sports injuries may be this type, necessitates the application of educational and scientific training principles to a much greater extent than has been done so far, especially if the injured person is an elite athlete. The aim of every rehabilitation programme in sports injuries is this athlete who is Pain Free, Functioning, Tough and able to take part in competitions.
The rehabilitation process should be designed, controlled and evaluated by a physician, but it is a process continuing more weeks and months and this process is done in team work with the patient, the therapist and the medical doctor.

31. SKI CAMP DOCTOR TRAINING IN HUNGARY

P. Felkai

SOS Hungary Medical Service

Many Hungarian skiers (mainly children) suffered fatal ski-accidents in the last years abroad. This sad fact has leaded to the basic idea of ski-camp doctor training for Hungarian general physicians and for doctors of different specialty. The school-groups should be escorted by those doctors, who are able to provide advanced life support on the scene and are trained either in the field of emergency medicine and in travel medicine. In the case of ski-emergencies, a well-prepared and continuously educated physician should treat the patient on spot. The main tasks of a camp-doctor are: pre-travel advice, treatment of the common (travel-related) diseases, providing basic and advanced life-support on the scene, and to organize the hospitalization and repatriation of patient together with the hospital- and insurance doctor.

The great success of the first session approved the proper way of the basic idea. The topics of postgraduate medical course were alpine medicine, emergency and travel medicine (advanced life support, environmental hazards, hypothermia, diabetes, etc.), as well as basic legal- and insurance information. Moreover, the ski-technique and movement of participants has been improved on different ski slopes and off-piste routes.

As for the chronic (diabetic, cardiac, etc.) patients, the skiing is “extreme sport”. The presence of a ski-camp doctor could minimize the risk during their sport activity. This kind of training could prevent the fatal consequences of an accident and decreases the number of travel related illnesses.

In the future, the course should be developed according to international standards, involving some experts from abroad.

While Hungary has no high mountains, the training took place in one of the Austrian ski center with all-year snow. *Because of both the complexity of professional and supplementary lectures and trainings in theory and practice, finally the developing of ski-running technique notions of medical colleagues we consider* ski-camp doctor training, is a pioneering method *in Hungarian medical education at all.*

32. ACCIDENT PREVENTION IN A SKI RESORT. THE EXAMPLE OF GRANDVALIRA IN ANDORRA

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Grandvalira is the largest ski resort in the Pyrenees, born from the union of Pas de la Casa – Grau Roig and Soldeu – El Tarter in the season 2003-2004.

There are 193 km of slopes, on a surface near 2000 Ha, 43% equiped with artificial snow, modern lifts allowing more than 100 000 users/hour, but at least our customers safety is one of our bigest challenges.

We consider difents aspects of safetys:

- Avalanche prevention
- Snow conditions (ice, wind, irregular snow conditions...)
- In crowdy days devices to reduce users speed
- Continuous control for quick assistance in case and detection of dangerous attitudes
- In case of accident collect of complete data to identify risk factors and dangerous points
- Prevention actions

This work is mainly done by the ski patrols but involves also the medical centers and other resort's workers.

33. ENGINEERING ANALYSIS OF TERRAIN PARK FEATURES

J. SHEALY

This coming winter we are greatly expanding our work on terrain park engineering design and usage that was reported this spring at Aviemore, Scotland. We are doing a more in-depth biomechanical analysis of the actions of jumpers on terrain park features such as table-tops and cheese-wedges. We are looking at any differences that might exist between skiers and snowboarders, the relationship between the length of the deck of the feature, the speed of the jumper and where the jumper lands in conjunction with the behaviour of the jumper in terms of if they are: pre-jumping, popping the jump, or using a neutral body posture. We will also determine the frequency of such jumps on small, medium and large features. We are greatly expanding our data base (currently only 51 jumps on one feature at one resort). We will be gathering data from at least three different size jumps at each of seven (or more) major ski resorts across the US this winter. We will record a minimum of 100 jumps per feature at each resort and thus anticipate a total data base well in excess of 2,000 individual jumps where for each jump we will record the length of the deck, the speed of the jumper, where they land, jumper behaviour, type of aerial maneuver, landing attitude, and if the jumper is a skier or a snowboarder. Each jumper's actual landing point will be compared to the theoretical landing point based on jumper speed, take-off ramp angle and classic Newtonian ballistic projectile motion principles. This information will be used to determine appropriate engineering design principles for such features so as to promote safer usage and thus reduce the incidence of injury.

34. HOW DO WE MANAGE IN BAQUEIRA-BERET MEDICAL CENTER?

M. Aleix Vidal

1. EPIDEMIOLOGY OF SKI INJURIES IN BAQUEIRA-BERET

For the last 15 consecutive winter ski seasons (1992-2007) we have seen 40.000 ski injuries (39.667 medical records). During the same period of time, nearly 3.000 different patients have been seen for other medical reasons. More than 10.000.000 ski lifts tickets were sold during that period of time.

This means that the probability of seeing a sport injury in our Medical Centre has been 3.3 per 1.000 visitors (between 2.4 to 5.3 depending on the season). It is interesting to note that the sexual distribution has always shown a mild inclination towards males. This tendency increased with snowboard injuries. Snowboard injuries were first seen in our resort during the 94/95 season. Snowboarders are twice as likely to get injured as skiers. Meaning the probability of seeing a snowboard injury in our Medical Centre is 5.29 per 1.000 snowboarders compared to 2.51 per thousand skiers.

The average age was also different depending on the speciality: The average age for injuries in skiers is 34 years compared to 27 for snowboarders. Carving ski injuries were seen for the first time in our resort in 1997 and progressively substituted the regular downhill ski injuries up to the present time. Carving skis account for 90% of the skis generally used in our slopes. In 2003 we started to see skiboard and freestyle ski injuries due to the technical equipment changes our visitor prefer.

Considering all the specialities together, lower extremity injuries represent 47% of global diagnostics. Upper extremities are involved in 35% of accidents, and chest/spine represent 10%. Head and neck were affected in 6% of total injuries.

ACCORDING TO DIAGNOSIS: "Contusions" has been the n°1 diagnosis in all anatomical locations. "Fractures" were mainly seen in upper extremities while "Ligament sprain" were mainly representative for lower extremities. Scars has been the main diagnosis in head and neck injuries. During these past 15 ski seasons we can compare the evolution of some specific diagnosis. We observed a decreasing tendency in knee ligament injuries while tibial fractures, ACL ruptures, and skier's thumb lesions stayed constant during all seasons.

Wrist fractures, acromio-clavicular injuries, and shoulder fractures have shown an increasing incidence.

Collisions represented 0.31 injuries per 1.000 visitors (from 0.5 to 0.1 per thousand) and we have not observed a tendency to increase or decrease when comparing the last 8 seasons. Comparing groups, snowboarders have not shown any difference in collisions compared to downhill skiers. Generally speaking when a snowboard collides it usually happens against an object (pole, rock, tree, etc.) and skiers tend to collide with other skiers.

Life threatening injuries are seldom seen, but they may occur. These injuries are usually related to high speed or outside boundary skiing.

2. ORGANIZATION OF OUR MEDICAL SERVICE IN BAQUEIRA-BERET

Visitors in our ski resort vary from season to season depending on the quantity of snow and the economy of the country. The average is around 780.000 ski lift tickets per season. The vast majority of visitors are downhill skiers, being the snowboard population of 21% of the total. Our resort spreads around three different areas: Baqueira, Beret and Bonaigua. The distance between areas is large. Skiers need more than three hours to ski from across the entire ski resort. In car Beret is 7 Km. away from the main Medical Centre in Baqueira 1500 and Bonaigua is 5 Km. away. To cover medical care, we have three separated first aid areas where we treat patients. Two doctors are distributed in different stations on the slopes and two more doctors are permanently located in Baqueira 1500 Medical Centre. During weekends, a third doctor (usually a Trauma specialist) joints the two doctors at the medical centre.

The main function for doctors on the slopes is to be there in case of any medical emergency or a severe trauma. 34 ski patrol members cover the on site rescue and snow transportation in the resort. In case of a life threatening episode the ski patrol members ask the doctor to assist them and if it happens to be a critical situation, the patient is directly referred to the local hospital, avoiding a stop at the Resort Medical Centre.
Specific protocols are written to define the way each accident should be treated. Unless specified all the injuries are sent to the Medical Centre where X-rays can be taken, fractures and dislocations reduced, and wounds can be sutured.
All the information is computerized for business purposes and statistic studies.
10% of our patients need to be sent to the hospital, usually patients with spine fractures, pelvic or femoral fractures, abdominal trauma and head concussions.

3. HOW WE DETERMINE THE PATIENT THAT IS GOING TO NEED INMEDIATE SURGERY OR CAN BE REFERED TO A MEDICAL CENTER IN HIS HOME TOWN

As previously said, the vast majority of sport injuries in the ski resort are treated on site but some need to be sent to a hospital. The transportation is usually made by ambulance. Heli-transportation is also used depending urgency of the case. On the other hand, patients are commonly treated in our centres. Fractures are reduced and immobilized avoiding vascular or neurological consequences and the patient is referred to his doctor at home. Dislocations are also reduced in situ. General analgesia and a quick reduction are usually enough to reduce the dislocated joint.
Post-reduction X-rays are routinely taken for both fractures and dislocations. The patients are informed about the chances of reduction again in their home residence. Neurovascular status is routinely tested before and after the reduction. But we still have some patients that we can not avoid advising to have surgical treatment at hospital.
Diagnosis that we advise to be operated on, depending on the location:

1. Lower extremities:
   Femoral fractures.
   Conminuted intra-articular fractures in the knee, displaced more than 3 mm.
   Displaced tibial tuberosity fractures displaced more than 5 mm.
   Displaced, after reduction, of an ankle fracture-dislocation.
   Complete Achiles tendon disruptions.
   Unstable fibular tendon dislocations.
2. Upper extremities:
   Displaced and/or rotated 5th metacarpal fractures.
   Displaced scaphoid fractures.
   Flexor tendons ruptures.
   Grade III skier's thumb injuries.
   Displaced intra-articular fractures in the wrist.
   Monteggia fractures at the elbow joint.
   Shoulder fracture-dislocations.
   Displaced distal third fractures of the collar bone.

Aside from the pathologies listed above, all pelvic and spine fractures are immediately referred to the area hospital. All head concussions and cranial contusion are also sent to the hospital.
Abdominal and renal traumas are first evaluated in our centres and if signs of serious injury are suspected, the patient is also referred to the hospital. Wounds are usually sutured in our center except if a neurovascular problem is suspected or if the size of the wound is too big (need of more than 20 cc. of local aesthesia to be sutured.

35. SKI INJURIES IN ANDORRA
1- GENERAL EPIDEMIOLOGY
2- EPIDEMIOLOGY AND MANAGEMENT OF SEVERE INJURIES

B. Escoda Alegret , J. Escoda Sales

In mountain areas winter sports generate an important amount of injuries, the presence of medical centers in the resorts optimizes the medical assistance giving immediate and specialized care to the patients. Most of them will leave this centers with an accurated diagnostic and first treatement until being checked by their own doctor's when returning home avoiding the area hospital. A small part will need to be seen in the area hospital for further explorations or hospitalary treatment. In both cases the importance of the ski resort medical center is evident. We will brievely present the epidemiolgy of winter sport injuries in our medical center, then our operation mode. Finaly, we will focus on the rare but important severe injuries.

36. TECHNICAL EXAMS AND NECESSARY EQUIPMENT

M.H. Binet

Avoriaz is a 15000 beds ski resort in the Center of the Portes du Soleil a French/Swiss ski area of 14 ski resorts.
The medical is the unique medical structure for the resort situated at 1800 m altitude. It is and fully equipped with material and physician to take care of the injured skiers and the medical cases.
It is opened 7 days a week from 8 in the morning to 8 in the evening during winter and summer seasons.
The first hospital is situated more than 1 ½ hour from the ski resort.
The medical team includes 5 physicians with one GP, one sports trauma specialist, one echographist, all physicians are trained for emergency medecine.
One of the physician is on duty all day long with the helicopter rescue service based in Avoriaz but used for more 30 ski resorts around.
3 nurses, 2 radio technician, 2 secretaries complete the team.
More than 3500 injured are treated each winter season.

The equipment includes:

2 radiography apparatus:

- one 700 milli power with digitized Xrays
- one fluoroscopy also with digitized images for extremities (ankles, wrists, elbows…)

One echography machine
all emergency material for rescue and resuscitation.




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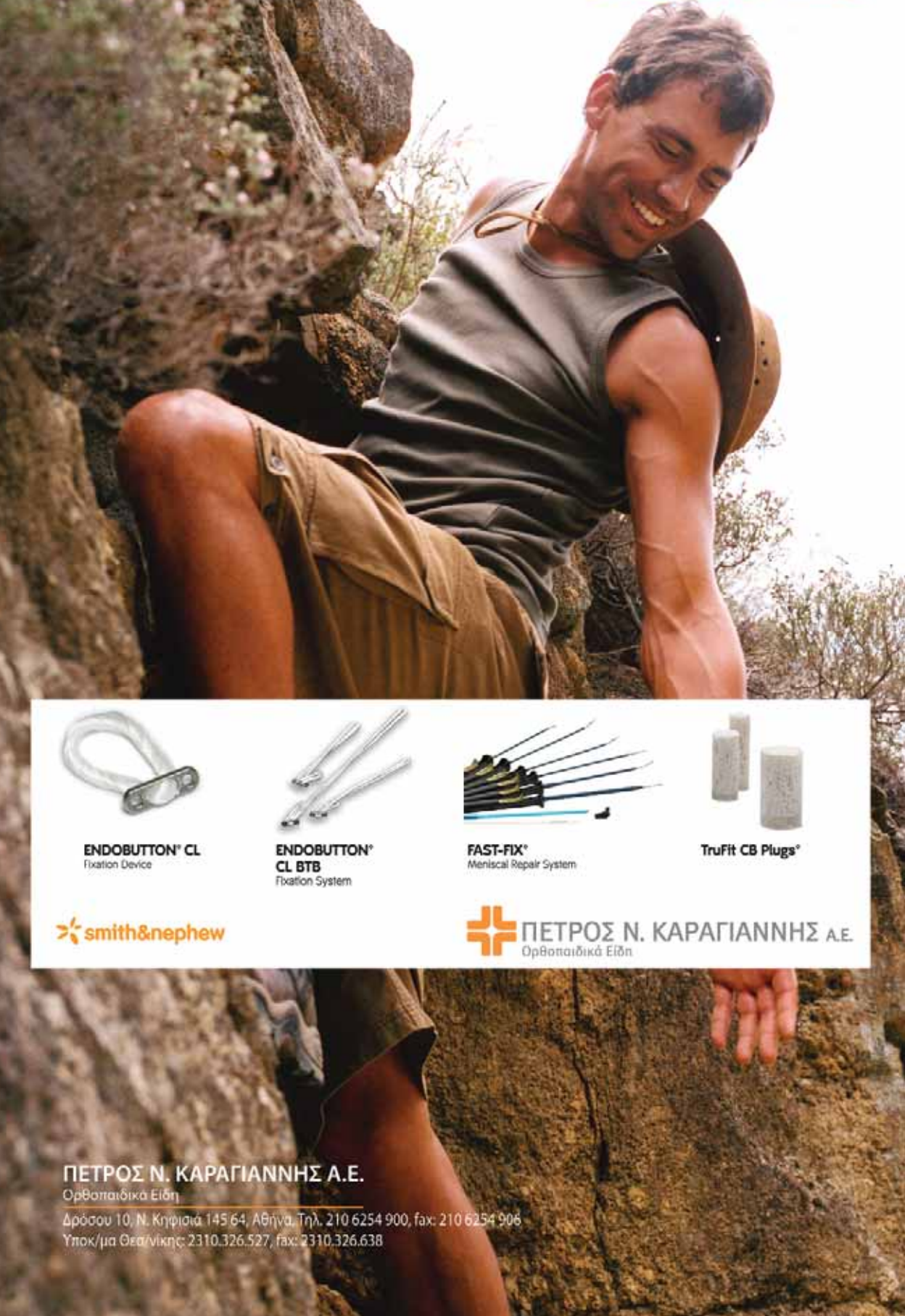

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