

History of SITEMSH

In the 1950s a group of experts in Orthopedics from the Alpine Countries (Austria, France, Germany, Italy and Switzerland) began to observe, collect and study the injuries coming from ski practice. They decided to meet every two years to discuss the first epidemiologic data, analyze equipment improvement and treatment of the injuries related alpine sports on behalf of a new Society named SITEMSH.

SITEMSH has organized more than 30 Congresses and has successfully influenced the media and manufacturers of downhill ski and snowboard equipment to increase awareness of strategies for injury prevention and advocate for equipment modifications related to the prevention of winter sport related injuries. Due to the influence of SITEMSH's findings, there has been an evolution of ski bindings as well as an increased use of helmets and braces in an effort to prevent head injuries and wrist fractures.

◆ Past Congresses

1st (1954) Chambéry Courchevel - FRANCE	18th (1988) Courmayeur - ITALY
2nd (1956) Sestriere - ITALY	19th (1990) Garmisch Partenkirchen - GERMANY
3rd (1958) Davos Parsenn - SWITZERLAND	20th (1991) Pas de La Casa - ANDORRA
4th (1960) Garmisch Partenkirchen - GERMANY	21st (1992) Obergurgl - AUSTRIA
5th (1962) Obergurgl - AUSTRIA	22nd (1993) Baqueira Beret - SPAIN
6th (1964) Chamonix - FRANCE	23rd (1996) La Plagne - FRANCE
7th (1966) Cortina d'Ampezzo - ITALY	24th (1998) Zermatt - SWITZERLAND
8th (1968) Saint Moritz - SWITZERLAND	25th (2000) Bormio - ITALY
9th (1970) Garmisch Partenkirchen - GERMANY	26th (2002) Andorra - ANDORRA
10th (1972) Obergurgl - AUSTRIA	27th (2004) Neustift - AUSTRIA
11th (1974) Val d'Isère - FRANCE	28th (2006) Baqueira Beret - SPAIN
12th (1976) Breuil Cervinia - ITALY	29th (2008) Delphi - GREECE
13th (1978) Arosa - SWITZERLAND	30th (2009) Termas de Chillan - CHILE
14th (1980) Garmisch Partenkirchen - GERMANY	31st (2010) Avoriaz - FRANCE
15th (1982) Obergurgl - AUSTRIA	32nd (2013) Bariloche - ARGENTINA
16th (1984) Val d'Isère - FRANCE	33rd (2014) Flachau - AUSTRIA
17th (1986) Saas Fee - SWITZERLAND	34th (2015) Tehran - IRAN

Chairman: Yukio Urabe

It is a privilege to be here with you at the 35th SITEMSH congress. I am especially honored to deliver this address under the auspices that this congress is convening in Japan for the first time ever in its storied history.



Fukushima Prefecture is on the road to recovery from the Great East Japan Earthquake and Tsunami, which occurred 5 years ago. As you can see on the map, the disaster-affected areas are located quite far from Hiroshima University, the faculty affiliation to which I belong. However, Hiroshima University has conducted a wide range of supporting activities in coordination with Fukushima Prefecture since the disaster. Thus, we decided to hold this congress in the Fukushima area proper in the hopes that the relationships strengthened and progress made here might contribute to acceleration in the pace of recovery from the disaster going forward.

The 35th SITEMSH congress consists of 9 sessions, ripe with opportunities for participants to be able to discuss and share their new knowledge with each other. This time, we have gathered 50 presentations. We hope to have lively discussions. It is our intention that this congress will have a positive impact on participants from Japan and around the world. Additionally, we hope that you will enjoy the 3 special talks that prominently feature topics in Japanese.

The venue of this congress, Listel Inawashiro, is conveniently located near the fourth largest lake in Japan, Lake Inawashiro, and encompasses a panoramic view of Mt. Bandai. This area includes one of the most famous mogul training ski courses in Japan – where many World Cup and Olympic athletes have appeared. So we invite you to enjoy the scenic beauty around the hotel. Maybe you will run into a famous athlete!

There are a number of activities available to you during the Congress. Skiing, hot springs, as well as an array of excellent cuisine such as sushi, Chinese-style noodles, yakitori (grilled meat on a stick), and many other Japanese dishes. Furthermore, Aizuwakamatsu City, next to Inawashiro Town, is famous for its historical structures like Tsurugajo Castle. We have also planned a tour of the tsunami-affected areas in Fukushima Prefecture.

As you may know, the 2020 Olympic Games will be held in Tokyo, Japan. Tokyo is one of the most famous cities in the world and is known for its safety and cleanliness. Although it is a metropolis, there are many buildings of historical importance such as the Imperial Palace there. Tokyo is a world-class place for shopping and sightseeing, so we think you will find it worth a visit during your stay in Japan. If you get the chance, you can also visit some other

great cities with world heritage sites. Kyoto is especially famous for its traditional architecture. You can get there in about 2-and-a-half hours by bullet train (shinkansen). There are two world heritage sites in Hiroshima Prefecture as well, which is about 4 hours by shinkansen from Tokyo. If you have time, we hope that you can visit Hiroshima.

We have prepared the 35th SITEMSH Congress with you, the participants, in mind, particularly in the hopes that we can all enjoy the pleasures of winter sports together. Our organization is excited to welcome you all. So on behalf of our organization, welcome to Fukushima, welcome to Hiroshima, and welcome to Japan!

Thanks to Hiroshima University, many enterprises, SITEMSH members who gave us much advice at science programs and laboratory members who made generous efforts for the congress' success, we are able to hold congress and I sincerely would like to give my gratitude for them. At last, I would like to conclude my thanking my family for supporting my activities.

13th March, 2016

Yukio Urabe

浦辺 幸夫

Yukio Urabe

浦辺幸夫 



With my family

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SCIENTIFIC PROGRAM



Sunday, March 13th

3:00 pm - Check-in & Registration

5:30 pm - Opening Ceremony — Bandai

- Music Performance

Koto (oriental harp; 琴) :

Presenter: Nozomi Suzuki

Performers: Ruri no Kai (瑠璃の会)

Sachiko Kobayashi, Eriko Kobayashi, Renon Chiba,

Shigeyo Shimada, Atsuko Sato, Tomomi Mori

- Opening Remarks

Yukio Urabe, *Graduate school of Biomedical & Health Sciences, Hiroshima University*

Guitar: Naoko Urabe

5:50 pm - **Opening Lecture 1**

Moderator: Yukio Urabe

Skiing- or snowboarding-related injuries: epidemiological analyses, prevention and on-site first aid (p.19)

Koichi Tanigawa, MD, Ph.D.

Fukushima Global Medical Science Center, Fukushima Medical University

6:20 pm - **Opening Lecture 2**

Moderator: Nobuaki Moriyama

Unexpected impacts caused by Fukushima Daiichi nuclear power plant accident (p.20)

Tomoyoshi Oikawa

Vice-director, Minamisoma Municipal General Hospital

6:50 pm - Music Performance — Bandai

Koto (oriental harp; 琴) :

Presenter: Nozomi Suzuki

Performers: Ruri no Kai (瑠璃の会)

Sachiko Kobayashi, Eriko Kobayashi, Renon Chiba,

Shigeyo Shimada, Atsuko Sato, Tomomi Mori

Guitar: Naoko Urabe

7:30 pm - Welcome Dinner — Tenkyo

Monday, March 14th

6:45 am - Breakfast – Tenkyo

9:00 – 10:45 am **Session 1: Shoulder injuries**

Moderator: Marc-Hervé Binet & Kenichi Otoshi

- 1. Shoulder dislocations in snow sports** (p.21)
Bernat Escoda, *Centre Mèdic Pas de la Casa-Grau Roig, Grandvalira Ski Area, ANDORRA*
- 2. Acromio-clavicular dislocations. Epidemiology** (p.22)
Aleix Vidal
- 3. Proximal humeral fracture - surgical treatment** (p.23)
Alexander Genelin, Andreas Gander, *Department of Traumatology, General Hospital Hall, Tirol, Austria*
- 4. Upper limb injuries in winter sports – case reports of selected injuries** (p.24)
Andreas Gander, Alexander Genelin, *Department of Traumatology, General Hospital Hall, Tirol, Austria*
- 5. Collar bones fractures** (p.25)
MH Binet, JM Bertrand, *Centre Medical Avoriaz, 74110 Avoriaz, FRANCE*
- 6. Rehabilitation strategies for shoulder injuries** (p.26)
Yasuyuki.Ueda, *Department of Rehabilitation, Nobuhara Hospital*

10:45 – 11:15 am **Break**

11:15 am – 1:00 pm **Session 2: Snowsport: Less Common Activities in the Slopes**

Moderator: Joan Torrens & Noriaki Maeda

- 7. Less common snow sports injuries** (p.27)
Joan Torrens, *Centre Mèdic d'Ordino-Arcalís, Vallnord, ANDORRA*
- 8. Snowparks - fun and danger** (p.28)
Dominik Heim
- 9. Ski injuries in Paralympic athletes** (p.29)
Aleix Vidal, *Centro Medico Baqueira & Centro Medico Teknon Barcelona, Spain*
- 10. How should we support the sit-skiers?** (p.30)
Hironori Fujishita, Yukio Urabe, Noriaki Maeda, Miho Morita,
Graduate School of Biomechanical & Health Sciences, Hiroshima University, Japan
- 11. The barrier-free situation in ski areas in Hiroshima** (p.31)
Miho Morita, Yukio Urabe, Noriaki Maeda, Takuya Takeuchi,
Graduate School of Biomedical & Health Sciences, Hiroshima University, Japan

1:00 – 3:15 pm **Lunch & Free time**

3:15 – 4:45 pm Session 3: Epidemiology

Moderator: Bernat Escoda & Kinshi Kato

- 12. Snow sport injuries epidemiology in a Japanese ski area** (p.32)
Yuiko Matsuura¹, Yukio Urabe², Noriaki Maeda², Nobuaki Moriyama²
¹*Machida Orthopedic Clinic, Japan*
²*Graduate School of Biomedical and Health Sciences, Hiroshima University, Japan*
- 13. The prevalence and characteristics of thoracic outlet syndrome in high school baseball players** (p.33)
Kenichi Otoshi¹, Ryohei Sato², Takahiro Igari², Takahiro Kaga¹, Kinshi Kato¹, Hiroaki Shishido¹, Shinichi Konno¹
¹*Department of Sports Medicine, Fukushima Medical University School of Medicine*
²*Department of Orthopaedic Surgery, Fukushima Medical University School of Medicine*
- 14. Evolution of snowsports injuries in France since 1992** (p.34)
MH Binet, JD Laporte, *Centre Medical Avoriaz, 74110 Avoriaz, FRANCE*
- 15. Evolution of Snow Sport injuries in children** (p.35)
Bernat Escoda, *Centre Mèdic Pas de la Casa-Grau Roig, Grandvalira Ski Area, Andorra*
- 16. Evolution of knee injuries in snow sports** (p.36)
Aleix Vidal, *Centro Medico Baqueira & Centro Medico Teknon Barcelona, Spain*

4:45 – 5:15 pm Break

5:15 – 6:45 pm Session 4: Free Papers (1)

Moderator: Alexander Genelin & Afsaneh Safar Cherati

- 17. Investigation of hamstring and quadriceps activation in the squatting position - Examination of kyphosis at slope -** (p.37)
Hiroshi Shinohara¹, Yukio Urabe², Nobuaki Moriyama², Hironori Fujishita²
¹*Southern Clinic Orthopaedics and Internal Medicine, Hiroshima, Japan*
²*Department of Sport Rehabilitation, Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan*
- 18. Functional anatomy of flexor pronator muscles - as a dynamic stabilizer against elbow valgus stress** (p.38)
Kenichi Otoshi¹, Shinichi Kikuchi², Ryohei Sato², Takahiro Igari², Takahiro Kaga¹, Hiroaki Shishido², Shinichi Konno²
¹*Department of Sports Medicine, Fukushima Medical University School of Medicine*
²*Department of Orthopaedic Surgery, Fukushima Medical University School of Medicine*

(session continued on next page)

19. Age and gender differences in the bone maturation process of tibial tuberosity assessed by ultrasonography (p.39)

Yoichi Kaneuchi¹, Kenichi Otoshi^{1,2}, Kazuyuki Watanabe¹, Miho Sekiguchi¹,

Tomohiko Shigihara³, Yuichi Jumonji³, Shinichi Konno¹

Departments of ¹Orthopaedic Surgery and ²Sports Medicine, Fukushima Medical University School of Medicine, Fukushima, Japan

³Rehabilitation Center, Fukushima Medical University Hospital, Fukushima, Japan

20. The effects of biomechanical intervention for a patient who has residual knee pain for 9 months after anterior cruciate ligament reconstruction with gracilis autograft: a single case study (p.40)

Kohei Suga¹, Shigenobu Fukushima²

¹Yamagata Saisei Hospital, Department of Rehabilitation, Yamagata, Japan.

²Yamagata Saisei Hospital, Department of Orthopedic Surgery, Yamagata, Japan.

21. Visualization of anterior cruciate ligament injury mechanism with finite element simulation – Tibial internal rotation and dynamic knee valgus position – (p.41)

Shigeyuki Kato¹, Noriyuki Nagayama², Tsuneo Ohoka³, Taizan Shirakawa³, Yukio Urabe⁴

¹Hiroshima International University

²Industrial Technology Center of Okayama Prefecture

³Matterhorn Rehabilitation Hospital

⁴Hiroshima University

7:00 pm - Dinner – Tenkyo

Tuesday March 15th

6:45 am - Breakfast — Tenkyo

9:00 – 11:00 am Session 5: Severe injuries

Moderator: Dominik Heim & Nobuaki Moriyama

22. **What can be considered as severe trauma in snowsport, a literature review 15' (introduction of the session)** (p.42)
Dominik Heim
23. **Evacuation procedures in World Cup races in Austria** (p.43)
Anton Wicker
24. **Prevention of sport injury in alpine skiing- what is known?** (p.44)
Anton Wicker
25. **Abdominal and thoracic trauma** (p.45)
Dominik Heim
26. **Severe monotrauma** (p.46)
Dominik Heim
27. **Incidence of concussion over five seasons in a ski resort in Japan** (p.47)
Nobuaki Moriyama, Yukio Urabe, Noriaki Maeda,
Graduate School of Biomedical and Health Sciences, Hiroshima University, Japan
28. **The epidemiology of snowsport safety and the opportunities to reduce accident mortality and morbidity in the USA** (p.48)
Daniel Gregorie, *Snowsport Safety Foundation, San Francisco, CA*

11:00 – 11:30 am Break

11:30 am – 1:00 pm Session 6: Rehabilitation & Physical Medicine

Moderator: Yukio Urabe & Anton Wicker

29. **Sport specific rehabilitation after severe knee injuries in athletes** (p.49)
Anton Wicker
30. **Analysis of stop and twist movement** (p.51)
Yukio Urabe, Sho Iwata, Nobuaki Moriyama, Miho Morita, Eri Fujii, Noriaki Maeda,
Graduate School of Biomedical and Health Sciences, Hiroshima University, Japan
31. **Effects of taping to restrict knee valgus movement during single leg landing**(p.52)
Sho Iwata, Yukio Urabe, Noriaki Maeda, Eri Fujii, Shuhei Numano,
Graduate School of Biomedical and Health Sciences, Hiroshima University, Japan
32. **Motion characteristics of the thoracic, lumbar, and pelvic movements during trunk extension in the standing position in athletes** (p.53)
Yuta Suzuki¹, Yukio Urabe²
¹ *Matterhorn Rehabilitation Hospital*
² *Graduate School of Biomedical & Health Sciences, Hiroshima University*

1:00 – 5:00 pm Lunch & Free time

- 3:00 pm - SITEMSH National Secretaries Meeting

5:00 – 6:30 pm **Session 7: Free Papers (2)**

Moderator: Yukio Urabe & Aleix Vidal

- 33. Assessment of muscle contraction features by using Tensiomyography** (p.54)
Shogo Tsutsumi¹, Yukio Urabe¹, Noriaki Maeda¹, Kazuhiko Hirata²
¹*Graduate School of Biomedical & Health Sciences, Hiroshima University, Hiroshima, Japan*
²*Division of Rehabilitation, Clinical Support Department, Hiroshima University Hospital, Hiroshima, Japan*
- 34. Study evolution of noncontact anterior cruciate ligament injury mechanism** (p.55)
Di Xie, Jian-Hong Qi, Jun Dong, Qi-Pu Yin, Shan-Shan Wei, Feng Gao
Institute of Sports Medicine, Taishan Medical University, Taian, Shandong province, China
- 35. Association of verbal abuse and physical violence from coaches with joint and limb pains of children engaged in junior club sports activity- a cross-sectional study** (p.56)
Kaoru Kuroki^{1,3}, Yoshihiro Hagiwara^{2,5}, Yutaka Yabe², Kenji Kanazawa², Masashi Koide², Nobuyuki Itaya², Takuya Sekiguchi², Masahiro Tsuchiya³, Haruki Monma⁴, Ryoichi Nagatomi^{1,4,5}
¹*Division of Medicine and Science in Sports and Exercise, Tohoku University Graduate School of Medicine*
²*Division of Orthopaedic Surgery, Tohoku University Graduate School of Medicine*
³*Tohoku Fukushi University*
⁴*Division of Biomedical Engineering for Health and Welfare, Tohoku University Graduate School of Biomedical Engineering*
⁵*Center for Sports Medicine and Science, Tohoku University Graduate School of Medicine*
- 36. Repatriation of patients with winter sport injury** (p.57)
Peter Felkai
- 37. The investigation into availability of the new leg-dynamometer** (p.58)
Rieko Sasaki¹, Yoshio Koga², Go Omori³, Kazuo Endo⁴, Hiroshi Watanabe⁵
¹*Faculty of Health Sciences, Niigata University of Rehabilitation, Murakami, Niigata, Japan*
²*Ninohji Onsen Hospital, Shibata, Niigata, Japan*
³*Department of Health and Sports, Niigata University of Health and Welfare, Niigata, Niigata, Japan*
⁴*Department of Health and Nutrition, Niigata University of Health and Welfare, Niigata, Niigata, Japan*
⁵*Department of Rehabilitation, Nagaoka Chuo General Hospital, Nagaoka, Niigata, Japan*

7:00 pm - Dinner — Tenkyo

Wednesday March 16th

6:45 am - Breakfast —Tenkyo

Evacuation of injured patients from the snow (full day) —Grandeco Ski Resort

6:00 pm - Dinner —Tenkyo

Thursday March 17th

6:45 am - Breakfast – Tenkyo

9:00 – 10:45 am Session 8: Knee Injuries and their prevention in Snow Sport

Moderator: Aleix Vidal & Di Xie

- 38. Snow sport injuries in a ski resort. Our experience during 24 consecutive seasons** (p.59)
Aleix Vidal, *Centro Medico Baqueir & Centro Medico Teknon Barcelona, Spain*
- 39. Evolution of knee ligament injuries in winter sports** (p.60)
MH Binet, *Centre Medical Avoriaz, 74110 Avoriaz, FRANCE*
- 40. ACL injuries in alpine skiing and the principles that apply to their prevention**(p.61)
Christopher Brown, *Dept. Worcester Polytechnic Institute, USA*
- 41. Ski bindings and the mitigation of ACL rupture** (p.63)
Rick Howell, *Howell Ski Bindings, Stowe, Vermont, USA*
- 42. Training and rehabilitation for preventing knee ligament injuries** (p.65)
Yukio Urabe, Nobuaki Moriyama, Shuhei Numano, Noriaki Maeda,
Hiroshima University, Graduate School of Biomedical and Health Sciences, Sports Rehabilitation, Hiroshima, Japan
- 43. Mitigating knee injuries through material** (p.66)
Christopher Brown, *Dept. Worcester Polytechnic Institute, USA*

10:45 – 11:15 am Break

11:15 am – 1:30 pm Session 9: Biomechanics & Material

Moderator: Christopher Brown & Shunsuke Ohji

- 44. Pathomechanics of ankle injuries in Skiing** (p.68)
Afsaneh Cherati, *Rasoul-Akram Hospital, Iran University of Medical Sciences*
- 45. Kinematic errors leading to ski injuries** (p.69)
Haleh Dadgostar, *Assistance Professor, Sports Medicine Specialist, Iran University of medical sciences*
- 46. Knee kinematics during lateral-jumping and landing in female** (p.70)
Shuhei Numano, Yukio Urabe, Noriaki Maeda, Sho Iwata,
Graduate School of Biomedical & Health Sciences, Hiroshima University, Hiroshima, Japan
- 47. Difference in vertical ground reaction force between dominant leg and non-dominant leg at quick stopping motion** (p.71)
Takuya Takeuchi, Yukio Urabe, Noriaki Maeda,
Graduate School of Biomedical & Health Sciences, Hiroshima University, Hiroshima, Japan

(session continued on next page)

- 48. Relationship between Functional Movement Screen™ (FMS™) and physical assessment by gender in the healthy adults** (p.72)
 Noriaki Maeda, Yukio Urabe, Eri Fujii
Graduate School of Biomedical & Health Sciences, Hiroshima University, Japan
- 49. A correlation between restriction of ankle dorsiflexion and the position of the talus using MRI** (p.73)
 Takeshi Toyooka¹, Akito Takata¹, Shiro Sugiura^{1,2}, Yasutaka Omori¹, Satoru Ishikawa¹
¹*Nishikawa Orthopaedic Clinic*
²*Department of Bioenvironmental Medicine, Graduate School of Medicine, Chiba University*
- 50. Characterization of vertical and posterior ground reaction force during single leg jump-landing with body rotation** (p.74)
 Shunsuke Ohji, Junya Aizawa, Kenji Hirohata, Takehiro Ohmi, Tomomasa Nakamura, Kazuyoshi Yagishita
Clinical Center for Sports Medicine and Sports Dentistry, Tokyo Medical and Dental University, Tokyo, Japan

1:30 – 7:00 pm Lunch & Free time

7:00 – 7:30 pm Special Lecture

Moderator: Yukio Urabe

About “Yukimaji! 19” (p.75)

Fumiko Kato

Principal researcher in JALAN research center, Recruit Lifestyle Co., Ltd.

7:30 pm - Closing Ceremony – Bandai

- Young Researcher Award & Ski Competition Award

- Closing Remarks

Yukio Urabe, Graduate school of Biomedical & Health Sciences, Hiroshima University

8:00 pm - Gala Dinner – Tenkyo

Friday March 18th

Departure

ABSTRACTS



Listel Inawashiro Photo by Y. Urabe

Skiing- or snowboarding-related injuries: epidemiological analyses, prevention and on-site first aid

Koichi Tanigawa, MD, Ph.D

Fukushima Global Medical Science Center, Fukushima Medical University

High speed sports such as skiing and snowboarding are inherently accompanied by the risk of life-threatening conditions such as severe head trauma and injuries to internal organs. In addition, as the population is aging rapidly, older people who are more susceptible to injuries account for the higher proportion of ski and snowboarding enthusiasts.

Girardi et al investigated severity of skiing and snowboarding injuries presented to the emergency department in South Tyrol. They found that men and non-local residents experienced more severe injuries than women and local residents, and Injury Severity Score (ISS) was higher for people aged over 60. The severity of the injuries increases with age.¹ Another group analyzed and compared skiing and snowboarding injuries on Utah slopes, reporting that high percentages of patients among both groups had suffered injury to the head, which was more common in snowboarders when compared with skiers. Skiers were more likely to sustain injuries to the lower extremities, whereas snowboarders commonly had injuries to the abdomen and its organs.² Regarding severe injuries related to these sports, higher incidence of critical injuries (ISS > or = 25) was reported in the non-local resident patients.³ The risk for head injury was 1.5 times higher among snowboarders than for alpine skiers.³ However, using a helmet was associated with a 60% reduction in the risk for head injury when comparing with head injuries with uninjured controls.⁴

These studies suggest that high risk groups for severe injuries include men, non-local residents, aged over 60, and snowboarders. Prevention and information programs should be targeted to people who are at high risk of severe injuries.

When skiing- or snowboarding-related injuries are witnessed, on-site first aid based on the international recommendations should be started promptly to prevent further deterioration of the injuries.⁵

References:

1. Girardi P, Braggion M, Sacco G, et al. Factors affecting injury severity among recreational skiers and snowboarders: an epidemiology study. *Knee Surg Sports Traumatol Arthrosc.* 2010;18:1804-9.
2. Wasden CC, McIntosh SE, Keith DS, et al. An analysis of skiing and snowboarding injuries on Utah slopes. *J Trauma.* 2009;67:1022-6.
3. Corra S, Conci A, Conforti G, et al. Skiing and snowboarding injuries and their impact on the emergency care system in South Tyrol: a retrospective analysis for the winter season 2001--2002. *Inj Control Saf Promot.* 2004;11:281-5.
4. Sulheim S, Holme I, Ekeland A, et al. Helmet use and risk of head injuries in alpine skiers and snowboarders. *JAMA.* 2006;295:919-24.
5. International Liaison Committee on Resuscitation (ILCOR). Guideline 2015. <http://www.ilcor.org/home/>

Unexpected impacts caused by Fukushima Daiichi nuclear power plant accident

Tomoyoshi Oikawa

Vice-director, Minamisoma Municipal General Hospital

5 years has passed since the Great East Japan Earthquake and the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident. There have been many reports on the FDNPP accident from various perspectives in these past 5 years, and now I would like to reconsider and reevaluate these reports from our point of view.

I am the vice-director of a hospital located only 23km away from FDNPP in Minamisoma City, and I have held this position since before the disaster. The nuclear accident was a terrible event, and significantly affected this city. In fact, 90% of residents in Minamisoma evacuated within several days after explosion of FDNPP.

What kind of changes were caused in Minamisoma city after this massive evacuation? One answer is that we can now clearly see a rapidly aging society. After 1 or 2 months from the nuclear accident, older residents gradually came back their homes, but younger people have seldom returned. In other words, Minamisoma became an aging society in the span of only one or two months. Because there is no clear family register data around Chernobyl, demographic changes after the nuclear accident in Fukushima, particularly in Minamisoma, are the first of these types of reports in the world.

Can we overcome rumors? From the early stages of the disaster, radioactive decontamination has taken place, and we have investigated external and internal radioactive contamination in residents. Surveys of radioactive contamination have shown very low doses that could lead to little deterministic and stochastic effects in Fukushima prefecture. But we have not yet overcome all the rumors that spread and confused us after the disaster.

Disaster-related death also deserves discussion. Even though radioactive contamination is not a major source of harm, our research have revealed that evacuation itself may result in significant damage to health. We assessed the death rate in 5 senior care homes in our city, and found that 328 nursing home residents had been transported to another nursing home after disaster as means of evacuation. Within this group, 75 people died within one year after transportation, a death rate 2.7 times higher than the nursing home non-evacuees. We have also been researching stroke incidence after the disaster, and found that the incidence spiked just after the disaster. Even now, the stroke incidence is about 1.4 higher than before the disaster, indicating a long-term effect.

Various issues remain unresolved in our city and prefecture now. I would like to present to you in this session not only the effects of radiation to our health, but also surrounding causes of confusion and other problem occurring because of this disaster.

1. Shoulder dislocations in snow sports

Bernat Escoda

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Keywords: shoulder, dislocation, snowsports, injuries, glenohumeral, ski, snowboard

Glenohumeral dislocations are often seen during Snowsports accidents. This injury can be associated with bone fractures or neuro vascular complications. A significant number of glenohumeral dislocations are recurrent. Quick reduction of glenohumeral dislocations can be performed at the ski resort medical center.

Glenohumeral dislocations treated in our during the last ski seasons, were analyzed using questionnaires, patients' records and X Rays images.

Results: to be presented at the conference.

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2. Acromio-clavicular dislocations. Epidemiology.

Aleix Vidal

3. Proximal humeral fracture - surgical treatment

Alexander Genelin, Andreas Gander

Department of Traumatology, General Hospital Hall, Tirol, Austria

Keywords: subcapital fractures, 3 and 4 part fractures, shoulder injury, treatment of proximal humeral fractures

Treatment of subcapital fractures and Case reports will be analyzed.

Background: The proximal humerus fracture is still one of the unsolved problems in trauma. In skiing the number of cases increased in the last years. The age of the patients reaches from 10 to almost 80 years.

Aim: To find the optimal surgical techniques fitting each age group.

Methods: Comparing the different surgical techniques regarding post trauma early recovery.

Results: Intramedullary fixation showed the best outcome regardless of age.

Conclusion: In our opinion, intramedullary fixation is the superior technique.

4. Upper limb injuries in winter sports – case reports of selected injuries

Andreas Gander, Alexander Genelin

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5. Collar bones fractures

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Keywords: Winter sports, collarbone fractures, clavicle, snowboard, immobilization vest

Collarbone fractures are a common injury in winter sports. Since snowboarding has become popular, clavicle fractures are seen quite often by doctors working in ski resorts. The injury can also occur by alpine skiers after a direct fall on the shoulder.

This injury is often extremely painful. The transport, the immobilization are the main difficulties for emergency care. The treatment in the vast majority of the cases is conservative.

The classical fracture is situated in the medial third of the bone. In case of displacement the bone is angulated and its length shortened specially if there is a third piece.

These fractures are difficult to take care. Eight splint is the usual material used to immobilize the clavicle and try to maintain a retropulsion of the shoulder. This immobilization is not comfortable and could bring skin damages in the deltoid furrow. The painkillers either given per os or by injection are not very efficient for the pain.

Our protocol for the pain is to make a local anesthesia with lidocaine in and around the fracture site.

This method is safe and without any complication. It is very efficient for the pain. This enable to proceed to immediate care, taking with X rays and reduction of the fracture.

For the immobilization we have developed a special vest with a long scratch tissue able to maintain the arm in a backwards position. The forearm is horizontally supported which allows not to pull down the shoulder with the weight of the arm. We have used this new vest for 4 years. The comparison with classic immobilization protocol shows a better comfort in the first week following the fracture. The results at the end are similar.

Local anesthesia and a good reduction and immobilization technique is important to take properly care of a clavicle fracture.

6. Rehabilitation strategies for shoulder injuries

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Keywords: shoulder dislocation, acromio-clavicular separation, rotator cuff tear

Shoulder injuries commonly occur in relation to winter sports activities. They sometimes involve severe injuries like shoulder dislocation, acromio-clavicular separation or rotator cuff tears. Rehabilitation after these injuries is important not only to help patients to get back to pre-morbid activities but also to prevent re-injuries.

As for conservative treatment of shoulder dislocation, prevention of its recurrence is a top priority. Shoulders were immobilized for 2 or 3 weeks to reduce pain or swelling around the shoulder. Exercises forcing the arm to external rotation with abduction should be avoided. In Nobuhara Hospital, patients were operatively treated by the method which modified Putti-Platt technique. The procedure was to shorten the subscapularis tendon and anterior capsule to prevent recurrence. Since the muscle or capsule was treated, aggressive external rotation or muscle strength exercise for internal rotation should be avoided 6 weeks after operation.

In patients with acromio-clavicular separation, the stress on the acromio-clavicular joint must be avoided. Therapists should also be aware of scapular downward rotation which leads to tense the brachial plexus in the upper extremity. This injury was often treated by operation using hook plate. The hook over the acromio-clavicular joint maintains the scapula while restoring the coraco-clavicular ligament. After operation, the therapists should set range of motion exercise below 90 degrees of elevation because motion of the acromio-clavicular joint is limited by the plate. Range of motion exercises causing excessive loads on the acromio-clavicular joint should be reduced after removal of the plate.

For patients with rotator cuff tear, it's important not to cause acromial impingement, any contraction or stretching of the injured muscles during physical therapy. If some rotator cuff muscle is ruptured, other unaffected muscles have to cover the function of damaged muscle. Accordingly one of the aims in rehabilitation was to exercise uninjured muscles for better shoulder function. In the rehabilitation protocol after surgery, care should be paid not to overload at insertion of the repaired tendons from 6 to 12 weeks after operation. In case ratios of the glenohumeral and scapulothoracic joints are altered after operation, therapists should give attention to rhythms or patterns of motions of the humerus and the scapula in addition to gaining range of motion and muscle strength for good shoulder function after surgery.

7. Less common snow sports injuries

Joan Torrens

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Keywords: snowsports, injuries, speedriding, snow bikes, SBX, ski mountaineering

Snow Sports Injuries are largely described from different points of view: epidemiology, specific injuries, evolution, means of prevention...

But when we focus on what snow sports we are talking about we see that the studies treat mainly about skiing and snowboarding.

Our resort, Ordino-Arcalís, part of Vallnord Ski Area, is developing the practice of different Snow Sports:

Speedriding, Snow Bikes, Adapted Skiing,

And hosts also competitions of not so popular disciplines:

Freeride Skiing and Snowboarding, SBX (snowboard border cross), Ski Mountaineering

Ski resorts are developing new activities beyond alpine skiing and snowboarding, the emergence of new disciplines provides new trends in snow sports injuries we should be aware of.

Our Experience shows changes mainly in injury rates and injury severity.

8. Snowparks – fun and danger

Dominik Heim

Keywords: 65,000 ski- and snowboard accidents/year in Switzerland
4,800 (7.4 %) in snowparks
77 % due to jumps
60 % 10-19 years old
Prevention: physical, psychological, social, protective gears

9. Ski injuries in Paralympic athletes

Aleix Vidal, PhD

Centro Medico Baqueira & Centro Medico Teknon Barcelona, Spain

Introduction: In order to identify if individual factors such as sport specialty, age, gender and training are related to Snow Sport injuries, we have independently studied injured athletes in both non-impaired and impaired populations. We compared the overall general population of the ski resort along with 94 injuries in impaired athletes.

Methods: Since 1992, we have collected data from nearly 60,000 snow sport injuries in one single ski resort of Spanish Pyrenees. We have compared this population to 94 Paralympic Athletes treated at the same institution during three years.

Results: The overall rate of injury is 2.4 per one thousand skiers days in downhill skiing and 5.3 per thousand skiers days in snowboarders. We found the mean age for downhill skiers to be 33 yrs old while 26 in the snowboarding population. Gender distribution showed prevalence towards males in snowboard however male and female injury rate in skiing was an almost even 50%.

In the Paralympic population LW-11 and LW-12 were the most frequent functional class group. Gender distribution showed a high prevalence towards males in the impaired group while in the general population the gender distribution was even.

Body injury distribution showed a similar trend in both impaired and non-impaired population.

Overall diagnosis showed a lack of coincidence when comparing the two groups.

Knee ligament injuries and upper extremity contusions were the most frequent diagnosis in the non-impaired group. And Knee ligament injuries and fractures in the impaired population.

Snow quality distribution showed no correlation in this study.

For the impaired population the injuries occurred more while training than in competition.

Conclusion: Winter sports are in constant evolution and injuries occurred while practicing these sports result from multivariable factors. Constant change in techniques, materials and individual behavior make prevention a challenge for scientific investigation.

10. How should we support the sit-skiers?

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Keywords: adapted sports, sit-ski

Although engaging in sports is important for all individuals, it is more important for those with disabilities because it not only improves and maintains physical functions but also promotes those with disabilities in the society. In various sports, sit-ski is a winter sport for individuals with a disability in which they sit on an exclusive seat with a shock absorber on a ski, and performs it with an outrigger in both hands. All sit-skiers have impairment in their legs, and they are classified into different 5 classes according to their sitting balance.

We supported two sit-skiers with a spinal cord injury in Hiroshima last winter. What kind of assistance they required and what can be done to help them.

The situation wherein sit-skiers required assistance included lifting some tools (ski, outrigger, seat, and wheelchair) and transferring from the wheelchair to the sit-ski. Especially, transferring by themselves is difficult, because a seat with only one ski on the snow is unstable. One caregiver holds the sit-ski from behind, and it is necessary to protect the player from falling down. As the players are transferred to the sit-ski, someone set the ski seat beside their wheelchair. When players try to transfer from the wheelchair to the sit-ski, tilting the seat slightly makes the transfer easier because the distance between the seat and wheelchair is shorter. In addition, the environment of the skiing area is a limitation for the disabled player. For example, the long distance from the parking lot to the piste cannot be covered by a wheelchair or sit-ski for reaching. The ski lifts since this distance is quite large (about 500 m). The ski-resort employees transport the players to the ski lifts from the parking lot using a snow mobile.

Through support activities for sit-skier, the environment of ski area, and thoughtfulness of healthy individuals enabled the sit-skiers to enjoy skiing. Creating awareness about skiing for the disabled among healthy individuals is necessary in order to solve the sit-skiers' problems. It is important for the development of para-alpine skiing including sit-ski that the number of support staff is increased and everyone is informed. The solution of the environmental problems for sit-ski and better ways of increasing the awareness among healthy individuals is required.

11. The barrier-free situation in ski areas in Hiroshima

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Keywords: ski area, barrier-free, sports for the disabled

Introduction: Skiing amidst a magnificent, snowy landscape provides a rare feeling of freedom and sense of speed not only for people with healthy bodies but also for people with disabilities. Hiroshima ranks ninth in the number of ski areas in Japan and first in the Chugoku region (Ministry of Land, Infrastructure and Transport, 2015). Ski resorts' ability to accommodate skiers with disabilities has improved gradually, but some still hesitate to accept them due to environmental and safety concerns. This study aimed to investigate the situation regarding accommodation of skiers with disabilities and obstacles to their participation at ski areas in Hiroshima.

Methods: Questionnaires were sent to all 14 ski areas in Hiroshima. The survey addressed resorts' acceptance of skiers with disabilities and the extent to which their facilities are barrier-free. The choices regarding acceptance included "permitted," "negotiable," and "no permission." Respondents were asked to indicate their policy with respect to wheelchair users, prosthesis users, and with people with visual impairment, hearing impairment, and intellectual disabilities. Questions concerning resorts' facilities (parking area, rest houses, rest rooms and ski slopes) asked respondents to classify them as either barrier-free, usable with assistance from resort staff, or difficult to use.

Results: The response rate was 50.0% (7 of 14). With regard to acceptance of skiers with disabilities, none of the respondents selected "no permission" for any user group. Results for each group were as follows: wheelchair users, 4 permitted, 4 negotiable; prosthesis users, 4 permitted, 3 negotiable, people with visual impairment, 3 permitted, 4 negotiable; people with hearing impairment, 4 permitted, 3 negotiable; people with intellectual disabilities, 3 permitted, 5 negotiable. One respondent selected both categories for wheelchair users and people with intellectual disabilities in some instances. Of the seven participants, the following number indicated that each aspect of the facility was barrier-free: parking for people with disabilities, 4; ski slopes accessible independently, 0; assistance available from resort staff (on ski slopes and in the rest houses), 3; multi-purpose toilet, 3; restrooms accessible by wheelchair, 3.

Conclusion: The ski areas that returned the questionnaire were willing to serve and assist skiers with disabilities; however, the results showed that they are yet to achieve a barrier-free environment. Although being fully equipped to accommodate skiers with disabilities imposes some economic burden, assistance provided by resort employees could make access easier. In the future, making opportunities for people with disabilities to experience skiing is expected in Hiroshima.

12. Snow sport injuries epidemiology in a Japanese ski area

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Keywords: snowboard injury, ski injury, epidemiology

Introduction: The authors examined incidence at one ski area named Mizuho Ski Resort (M ski resort) in west Japan area nearby Hiroshima city from 2007 to 2013 seasons. The purpose of this study was to analyse the previous 7 season's injury incident reports, and to consider also the trend of incidence. This report will be useful for safety participation and prevention for winter sports injuries.

Methods: The incident reports were collected from the rescue team at the M ski resort and was analysed from 2007 to 2013 seasons (7 seasons) respectively. The items extracted in this study were as follows; total number of incidents in each season, equipment (ski or snowboard), severity of injury suffered, use of a helmet, and body part affected. The questionnaires were compiled as an annual report. All data of 7 years were analyzed. In this study, the incidence rate was calculated from the total number of snowboarders/skiers and the total number of injuries in 7 years.

Results: The number of injuries occurred 280, 255, 318, 331, 206, 250, and 261 from 2007 through 2013 seasons. Generally population of skiers is larger than that of snowboarders in Japan, however, at M ski resorts, 65% of guests are snowboarders. And the 82% of injuries occurred in snowboarding from 2007 through 2011 seasons, 84% in recent 2 seasons. The average rate of snowboarding injury was about 65% in Japan in 2013. At the M resort, the rate of snowboarding injury was higher than that of the whole Japan. The rate of ski injuries in 2007 through 2011 seasons and recent 2 seasons were 18% and 16% respectively. Approximately 6% of injuries were serious, which needed emergency service. Fatal accident never occurred in recent 7 seasons. Only 6% of participants injured wore helmets. About 21% of snowboard injuries occurred on shoulder joints, followed by wrist joint (12%), head (11%), lumber spine (8%), elbow joint (7%), and knee joint (6%). About 20% of ski injuries occurred in knee joints, followed by shoulder joint (14%) and lower leg (11%). The incident rates of skiers and snowboarders were 43.5 and 56.7 per 100,000 skiers/snowboarders, respectively. Higher incident rate in snowboarders compared with skiers.

Conclusion: At the M resort the rate of snowboarders are high, and 84% of injury occurred in snowboarding in the recent 2 seasons. Therefore, the M resorts need to implement some countermeasure for safety participation, especially snowboarding. In order to prevent winter sports injuries, we have to clarify the happened injuries in each of the ski resort, it would be important to carry out the measures of each of there.

13. The prevalence and characteristics of thoracic outlet syndrome in high school baseball players

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Keywords: thoracic outlet syndrome, baseball player, prevalence

Thoracic outlet syndrome (TOS) is one of the common neurovascular disorders of upper extremity, and the compression or traction of brachial plexus is considered to be the main pathology. However, there have been few report which describe the prevalence of TOS. The purpose of this study was to investigate the prevalence and characteristics of thoracic outlet syndrome (TOS) in high school baseball players.

One thousand two hundred ninety-one high school baseball players were included in this study. The prevalence of TOS and the association between TOS and shoulder/elbow pain over the previous one year were investigated.

Four hundred twenty-two players (32.7%) met the diagnostic criteria of TOS. Shoulder and elbow pain over the previous one years were observed 555 players (43.0%), and 644 player (49.9%), respectively. The prevalence of shoulder and elbow pain was significantly higher in the players with TOS compared with those of without TOS.

Our study demonstrated the association between TOS and shoulder/elbow pain in high school baseball players.

TOS might be one of the cause or exacerbation factor of shoulder and elbow pain.

14. Evolution of snowsports injuries in France since 1992

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Keywords: Winter sports, trend, injury, alpine skiing, Medial Collateral Ligament, Anterior Cruciate Ligament, radius fracture, snowboard

The French association Medecins de Montagne is running an epidemiological survey since 1992.

Knee injuries represent a very large amount of the total of the 4760809 injuries in the database. Knee sprains are the first injury for alpine skiing. Knee sprains can be classified in mild and moderate (grade 1 & 2 MCL) and severe knee sprains (grade 3 ACL isolated or associated with lateral damages).

The incidence of each type is measured each winter season and the evolution from 1992 to 2015 is described.

We have observed an improvement of the risk of knee injuries from the years 2000. The variation of each type is correlated to ski ability, different for each group. The incidence of ACL injuries have not decreased as much as MCL injuries. Knee injury rates are consistent among studies around the world. The differences observed are correlated to the ski resort specificities (more beginners, or more soft snow).

We use to compare each season the curves between leg and ankle fractures and ACL injuries for each age group for males and females. Despite the evolution of these injuries in the years the curves are always crossing around 13 years old for girls and 17 years old for boys. This confirms the influence of hormonal factors on the higher incidence of ACL for females.

The prevention of knee ligament sprains depends of different factors: physical fitness, fatigue, warming up, but also design and settings of the ski bindings. The types of alpine ski used have been compared without any statistical result.

Knee ligament injuries are always a challenge for a safe alpine skiing practice. Beginners, female and soft snow are the main risk factors.

15. Evolution of snow sports injuries in children

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Keywords: snowsports, injuries, children, adolescents, ski, snowboard, epidemiology

General epidemiology and injury specific publications about snowsports injuries are but few deal specifically with children and young ski resorts users.

Since season 2002-2003 all professionals in Andorra concerned with snowsports injuries share their data in a unique database.

Until season 2014-2015 153.551 injuries had been registered, an average of 9.576 per season.

We have been looking for specificities for the younger users of the ski resorts.

Results to be presented in the conference

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16. Evolution of knee injuries in snow sports

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Introduction: Knee injuries are evolving. Since first SITEMSH in 1958 to nowadays ski bindings have shown a tibia fracture diminution but knee injuries have shown an increase. We analyze the experience in a ski resort medical center related to knee injuries since 2005.

Methods: Since 2005 we have been collecting data in Baqueira Beret Medical Center in the Pyrenees. During eleven consecutive seasons we have recorded 10.319 knee injuries. We have analyzed the diagnosis and probability of injury for every knee lesion.

Results: ACL injuries represent 37.90 % of total knee injuries. MCL represent 47.00 % and sprain or contusions represent 21.69 %. Other diagnosis like LCL, tibial eminence fracture, tibia tuberosity fracture, PCL, segond fracture and multiple combinations of injuries represent less than 6 % each. Gender distribution shows a light predominance in females, for all different knee injury diagnosis. ACL injuries in females represented 55.44 % compared to 44.56 % in males. Mean age in ACL injuries was 39 years old. We have analyzed the variability among different knee injuries since 1999 and we have found the following results. Sprain and contusions stayed in a variant between 5 % and 15 % of all knee injuries. MCL has maintained between 10 % and 20 % of all knee injuries. LCL has maintained between 2 % and 4.5 %. Segond fracture has stayed between 0.2 % and 0.8 %. Tibia eminence avulsion has maintained between a 0.5 % and 2 %. Tibia tuberosity fracture has maintained between 1 % and 3 %. PCL between 0.05 % and 0.15 %. Patellar fractures between the 0.03 % and 0.06 %. Finally patellar dislocations has maintained between 0.05 % and 0.02 %.

Conclusion: ACL injuries and avulsion of tibia eminence remain a constant diagnosis throughout the years and tibia plateau fracture has a tendency to increase.

17. Investigation of hamstring and quadriceps activation in the squatting position

- Examination of kyphosis at slope -

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Keywords: squatting position, electromyography, slope

Introduction: When skiers return to the sport after injury, it is essential that they assume a squat position that imposes less stress on the knee joints. In addition, it is important to understand the degree of thigh muscle activation in squatting while skiing. In recent years, some studies have focused on muscle activation in the context of squatting on ski slopes (Kroll et al., 2010). We hypothesized that activation of the quadriceps femoris muscle while squatting on a slope is less than that on a flat surface because the lever arm (from the knee joint to the center of gravity) is shortened when squatting on a slope. This study aimed to compare the activity of the thigh muscles during squatting on both slopes and flat surfaces.

Methods: Six healthy men participated in this study. We measured the activities of the right quadriceps femoris muscles (vastus medialis, vastus lateralis) and hamstring muscles (semitendinosus, biceps femoris) during squatting. The angle of the slope was set at 20 degrees. The degree of muscle activation during squatting was divided by that during maximum voluntary contraction (MVC). A paired t-test was used for statistical analysis. A p-value < 0.05 was considered statistically significant.

Results: The degree of activity in the quadriceps femoris muscles during squatting on a flat surface (42.6 ± 7.1 %MVC) was lower than that on a slope (44.6 ± 6.5 %MVC) ($p < 0.05$). The degree of activity in the hamstring muscles during squatting on a flat surface (11.3 ± 6.7 %MVC) was higher than that on a slope (7.6 ± 2.7 %MVC).

Conclusion: We hypothesized that the activation of the quadriceps femoris muscles during squatting would decrease on the slope due to the shortened lever arm. However, the results of this study showed that activation of the quadriceps femoris muscles was significantly greater on the slope. This difference might be caused by pelvic retroversion in the squatting position on the slope. In this presentation, we will consider this phenomenon with a comparison of the alignment of spinal column in the squatting posture, and the animation at motions as an additional experimental data.

18. Functional anatomy of flexor pronator muscles – as a dynamic stabilizer against elbow valgus stress

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Keywords: flexor pronator muscles, dynamic stabilizer, elbow

Background: When pitching, tremendous valgus force is applied to the elbow joint throughout the throwing motion. Fleisig reported that the load on the MUCL during pitching appears to be near its maximum capacity. Flexor pronator muscles (FPMs) have been considered to play a key role in stabilizing the elbow joint against valgus forces. However, no studies have investigated the precise anatomy of FPM proximal origin and in vivo kinematics of FPMs against these forces on the elbow. The purpose of this study was to clarify the contribution of FPMs as a dynamic stabilizer against elbow valgus force.

Anatomical study: 52 elbows from 26 donated formalin-fixed cadavers were examined. FPMs converged and formed a two common tendons at their proximal origin (the anterior common tendon: ACT and posterior common tendon: PCT). The ACT and PCT were both attached to the medial epicondyle and the medial joint capsule, and parallel to the anterior oblique ligament. The ACT was well developed and histological morphologies were very similar to anterior fiber of medial ulnar collateral ligament.

Ultrasonographic study: 12 healthy volunteers participated in this study. Manual valgus stress was applied to the elbow joint, and the width of the ulnohumeral joint space was measured before and after isometric contraction of FPMs.

The Joint space was significantly decreased in forearm pronation, wrist palmar flexion, and finger flexion with decrease rates of 29.4 %, 15.9 %, and 6.4 %, respectively.

Conclusion: FPMs could function both as static and dynamic stabilizers against elbow valgus stress, and Pronator teres muscle, considered as main forearm pronator, may play the most important role as a dynamic stabilizer of all the FPMs. The results of this study may be useful in developing injury prevention and rehabilitation strategies for throwing injuries of the elbow.

19. Age and gender differences in the bone maturation process of tibial tuberosity assessed by ultrasonography

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Keywords: bone maturation, tibial tuberosity. ultrasonography

Introduction: Osgood-Schlatter disease (OSD) is one of the major disorders around the knee joint in adolescent athletes. Increased traction force to the patellar tendon is thought to trigger the apophysitis of skeletally immature tibial tuberosity (TT). Several studies' findings indicated that the degree of bony maturation is associated with OSD, but age and gender differences in the bony maturation process of TT have not been described. We sought to clarify the bony maturation process of TT in adolescent athletes, using ultrasonography.

Methods: Japanese basketball players aged 8–14 yrs (n = 477, 225 males, 252 females) who participated in an annual medical checkup were enrolled. We used ultrasonography to assess age and gender differences in the subjects' bony maturation status of TT by Ehrenborg's classification: cartilaginous stage (stage C), apophyseal stage (stage A), epiphyseal stage (stage E) and bony stage (stage B).

Results: The bony maturation of TT was advanced earlier in the females compared to the males (p < .01). The epiphyseal ossification center started to become visible (stage A) earlier in the females (i.e., at 9 years old) compared to the males (at 10 years old). Among the females, 59.3 % were already at stage E at 10 years old and 60.0 % were skeletally matured (Stage B) at 14 years old. Among the males 41.2 % were still at stage A or stage C at 12 years old and 76.2 % were still at stage E at 14 years old.

Conclusion: Our results revealed clear gender differences in the bony maturation process of TT in adolescent athletes. Since it is difficult to assess bony abnormalities of TT in skeletally immature athletes by diagnostic imaging, the presence of OSD in males < 12 years old and females < 10 years old might be underestimated. A combination of careful physical examination and soft tissue assessment using ultrasonography or magnetic resonance imaging might be necessary to achieve an accurate diagnosis in skeletally immature athletes.

20. The effects of biomechanical intervention for a patient who has residual knee pain for 9 months after anterior cruciate ligament reconstruction with gracilis autograft: a single case study

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Keywords: anterior knee pain, biomechanical intervention, ACLR

Introduction: Anterior knee pain is one of the most frequent complications after anterior cruciate ligament reconstruction (ACLR) with bone-patellar tendon-bone (BTB) autografts by direct invasion to the donor-side knee. However, it occurs in patients who have undergone ACLR with other grafts. Patients who had sustained ACL injury have impaired motion during sports activity. At the time of injury, patients with ACL tear experience a posterior shift in the center of gravity (COG) and low hip flexion angle with knee valgus. The increase in external knee flexion moment and decreased hip flexion angle and hamstrings and gluteus maximum activity caused due to the shift in position that reduces the muscles length, which further results in anterior knee pain. We aimed to describe the effects of biomechanical intervention in a patient with knee pain after ACLR.

Case Description: A 27-year-old male amateur skier had undergone ACLR with gracilis autograft. Despite 9 months after ACLR, he developed bilateral knee pain whenever he went skiing.

Evaluation/Intervention: His pain intensity score after skiing was 4-5 out of 10 (10 being the most intense) on a 10-point numerical rating scale (NRS). Before the intervention, the score of his landing comfort was measured 5 on NRS (10 being the most comfortable). He was instructed to perform two types of landing tasks from a 30-cm-high box: single-leg and double-leg landing. The tasks were captured by a digital camera and examined by a physical therapist. His landing feature was knee valgus and reduced hip flexion angle. Therefore, it was thought that increasing valgus motion and external knee flexion moment were caused by low hip flexion angle and posterior shift of COG. To modify his motion, the physical therapist showed him his landing motion on the digital camera instructed him to increase his hip flexion angle during landing. After the instruction, he practiced the tasks for 15 min by himself. His knee pain was reevaluated by phone at 13 days after the intervention.

Results: The patient's hip flexion angle was increased and knee valgus motion was modified. After the practice, the score of his landing comfort improved to 10 and his knee pain improved to 0.

Conclusion: Biomechanical approach was successful in improving the patient's condition. It is important to observe the motion carefully for the patients who had undergone ACL reconstruction and has knee pain, even though they never used BTB autograft.

21. Visualization of anterior cruciate ligament injury mechanism with finite element simulation -Tibial internal rotation and dynamic knee valgus position-

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Keywords: anterior cruciate ligament, injury mechanism, finite element simulation

Introduction: Most anterior cruciate ligament (ACL) injuries are known to occur by non-contact mechanisms of injury during sports participation. Bere et al. (2011) reported that the three main mechanisms of ACL injuries in skiers were identified as the slip-catch, landing back weighted, and dynamic snowplow. The underlying mechanism of ACL rupture is involved in dynamic valgus and internal rotation of the knee. Krosshaug et al. (2006) found that three-dimensional motion reconstruction from video sequences. These studies have shown that video analysis of kinematic characteristics, ACL injury situations from basketball, handball and skiing. The knee internal rotation peaked 40deg and the valgus angle was 15-30deg in the alpine skiing injury situation. The purpose of this study was using simulations to investigate the stresses in ACL under injury position that reported rotation of the tibia and knee valgus.

Methods: The subject was female (19 years, 163 cm, 50 kg) with a history of unilateral ACL injury. An intact left knee was assessed using MR imaging. The 3D reconstruction of the ACL, femur and tibia was carried out using 3D reconstruction software (ZedView and I-DEAS). The stresses and distribution of ACL were calculated by using the finite element analysis software MSC Marc Mentat 2015. The simulation that assumed an injury position (tibia internal rotation / knee valgus / tibia anterior displacement) was performed in a 3D computational knee model.

Results: Results of dynamic analysis using MSC Marc Mentat, the stress values in the ACL were approximately 60 MPa, that were determined in response to knee kinematics under 30-degree internal rotation of the tibia. High stresses were found with the 22-degree internal rotation of the tibia and 8-degree valgus.

Conclusion: This study shows that visualization as an example of an ACL injury situation by using finite element simulations. Our model suggests that the maximal stress of the ACL appeared to be internal rotation and valgus knee situations.

22. What can be considered as severe trauma in snowsport, a literature review 15'
(introduction of the session)

Dominik Heim

Keywords: major trauma, morbidity, mortality, snowsports

Alpine skiing, snowboarding and sledding have different injury-pattern. In alpine skiers there is an increased risks for chest and spinal injuries. Because of high energy trauma mechanisms all three groups show a certain risk of severe multiple trauma.

23. Evacuation procedures in World Cup races in Austria

Anton Wicker

24. Prevention of sports injury in alpine skiing – what is known?

Anton Wicker

Keywords: ACL prevention, adolescent skiers

Physical activity and sport is associated with benefits like an improved quality of life (1) and an overall reduction in mortality (2) and morbidity, (3, 4) but there remains an associated activity-related risk of injury and re-injury. (5)

In the last two decades was an increase in sport injury prevention research and development of prevention programs.

One well known example is the 11plus ® program of the International Football Federation (FIFA). (6) A further example is the use of Functional Movement Screen (FMS)®, a diagnostic tool to recognize increased injury risk depending on physical condition of the athletes. This method includes correction exercises and reduces injury risk. (7)

Next to old brought stretching, a new kind of therapy and training was established. This so called fascia therapy and fascia training is also used for injury prevention.

Well proved and established is core stability training (8) as protection against injury and accidents in sports.

Another risk factor for ACL rupture and hamstring injuries are muscular dysbalances of the thigh muscles. A special training program to compensate the dysbalances is related with a reduction of injury risk.

All these methods are well proven and established and can be used in assessments for winter sports and specially for alpine skiing.

Literature:

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25. Abdominal and thoracic trauma

Dominik Heim

Blunt abdominal, renal and chest injuries in snowsport-activities are rare. Because of their rarity they tend to be forgotten in the appreciation of these patients. Some typical personal cases are presented and compared with datas from the literature. Furthermore the need for sonographic examination is discussed

26. Severe monotrauma (personal series, case reports)

Dominik Heim

Cases of personal experiences with traumas at mostly the lower extremity are presented. These cases concern mostly the ankle- and knee-joint. Less frequent are cases at the upper extremity.

27. Incidence of concussion over five seasons in a ski resort in Japan

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Keywords: concussion, incidence, equipment

Introduction: Concussion is often a result of mild traumatic brain injury, and may be caused by impact force, in which the head strikes or is struck by something, or by impulsive forces, in which the head moves without itself being subject to blunt trauma. During sporting activity, concussion may occur in any event that involves physical contact between athletic situations where the players can fall, including skiing/snowboarding. This study aimed to investigate the incidence of concussion in a ski resort in Japan and identify the risk factors for concussion from data obtained regarding injuries.

Methods: Data on the injured dealt with by the ski patrol from a ski resort were collected from the 2007/2008 season to the 2011/2012 season (five seasons). The following data were analyzed in this study: total number of incidents in each season, date of injury, percentage of head injuries, severity of injury, and use of a helmet.

Results: A total of 1390 injuries occurred at the Mizuho Ski Resort, and the number of injuries in each season from 2007/2008 through 2011/2012 was 280, 255, 318, 331, and 206, respectively. Out of the total injuries reported over 5 years, head injuries accounted for 11 % (154/1390). Out of them, four injuries were identified as concussions. They occurred from December 19 to January 17, which is included in early snowsport season because it usually lasts until late March in Japan. Three out of four concussions were serious and required emergency services. None of the participants who suffered a concussion had been wearing a helmet.

Conclusion: The result of this study supported the results of a previous study that suggested most head injuries occurred early on in the season (Levy et al., 2002). In cases of winter sports, concussion occurs as a result of collisions with trees or with other skiers (Bridges et al., 2003). It is believed that collision occurs early in a season because those skiers/snowboarders are not yet accustomed with the course and may be out of practice.

Although the effect of wearing a helmet on concussion prevention is still controversial, it is obvious that it may mitigate the severity of head injuries to some extent.

Education for participants to use the course safely (i.e. to select a course suited to one's skills of skiing/snowboarding) and the use of helmets may be effective for prevention of concussion while skiing/snowboarding.

28. The epidemiology of snowsport safety and the opportunities to reduce accident mortality and morbidity in the USA

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Keywords: epidemiology, defined risk, safety plans, safety pyramid, public policy

Introduction: Recreational snow sports in the US have a significant but poorly recognized and defined risk of death and serious injury. There is virtually no safety regulation or oversight. There are no industry safety standards. Ski areas refuse to disclose safety plans or provide accident and injury statistics.

Determining the Public Safety Risk: In 2008 the Snowsport Safety Foundation (SSF), www.snowsportsafety.org, was founded in California to determine the actual public safety risk, to define its epidemiology and to research and publish the requisite information to catalyze and enable reduction of mortality and morbidity.

The Foundation's research has documented * significant inadequacy, inconsistency and variability between and within ski areas in their use of known accident prevention and injury reduction practices, methods and materials. SSF research of a statewide hospital payment database has documented ** a minimum of 11,500 snow sport injury emergency room and 630 hospital admissions per year in California costing an estimated \$75-100 M. Analysis of the same database reveals an exposure adjusted snow sport death and injury risk at least 5-15 X greater than driving an automobile. ***

Defining the Epidemiology: The Foundation has adopted a hierarchical epidemiological model, the Snowsport Safety Pyramid.**** The foundation of the Pyramid is Public Policy and Culture. US public policy strongly favors ski area liability protection at the expense of public safety and fosters deliberate ski area negligence. To conceal this negligence and the actual injury risk, ski areas refuse to disclose safety plans as well as accident and injury statistics. This safety information vacuum abets a general patron inclination to ignore and/or deny both the overall safety risk as well as any safety differential between ski areas.

Enabling Accident Prevention and Injury Reduction: Significant safety improvement at all levels of the Pyramid cannot be fully achieved without a change in public policy and / or the development of a patron driven safety imperative. Therefore, SSF's focus has remained on raising public and public policy maker awareness as well as providing patrons the necessary ski area specific information to consider safety in their selection of resorts.

29. Sport specific rehabilitation after severe knee injuries in athletes

Anton Wicker

Keywords: knee rehabilitation, sport specific rehabilitation, sensomotoric training

In injured high level athletes the time to come back to competition and training 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.

The following three aspects in this process should be in 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 sensomotor system should be given attention
3. It should be ensured, that the athlete's stamina is not overly impaired, especially in terms of strength, speed and endurance. A training program specifically designed to maintain the athlete's stamina should be pursued, as far as possible, even the athlete is affected by the injury

The treatment of complex mobility disorders, such as those encountered after knee surgery, 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.

A rehabilitation program for a ski racer or other elite athletes should be based on the principles of training and motion. The program should include exercises, training instructions and corrective measures, specially adapted to the sport and specific injury.

Phase I (1st week after surgery)

Acute Phase

Psychological evaluation of the injury

Pain-therapy (Medication, TENS, Positioning, Lymphmassage)

Patella-mobilisation

Gait-training (first two days with crutches)

Isometrics

Coordination (elastic-band-exercises)

Electrostimulation (in phase I 2 times daily with 20 minutes)

Phase II (2nd to 5th week after surgery)

Subacute Phase

In Phase II the athlete is in a rehabilitation center, so therapy can be done 6 to 8 hours per day by relaxation times in the room.

Pain management (Lymphmassage, Laser, Reflexzonenmassage, Kryotherapy, Acupuncture)

Mobilisation,

Functional massage

Manual technics

Underwater-therapy (Ski-specific-imitative Training)
Inner-training (an important aspect of inner training is trust in the human body)
Video training in water
Endurance training
Active mobilisation of the knee-joint
Stabilisation-training
Sensomotoric-training
Electrostimulation

Phase III (6th to 14th week after surgery)

Recovering Phase

Increase of regeneration, Lymphmassage,
Magnetic field therapy
Special massage technics
Sauna
Isokinetic training in closed chain modus
Power walking
Sensomotoric training (Swingboard, Trimilin, balance boards, multifunctiondisc)
Sliding board
Roller skating
Weight lifting, Strengthening, especially the trunk
Training on machines
Cycling
Aqua jogging

Phase IV (15th week to end of 6th month)

Stabilisation Phase

Begin of training with skiers on snow
Plyometrics
Running
Increase of trainingsintensity in stamina, strengthening, flexibility, balance and coordination
Reincorporation in the usual trainingsprocess

30. Analysis of stop and twist movement

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Keywords: ACL injury, laterality, side step cutting

Background: Anterior cruciate ligament (ACL) injury occurs in left leg more frequently than right leg, but the cause is not clear. So, it is very interesting to analyze the difference of causes of ACL injury between both legs. The aim of this study was to compare the difference of left and right knee joint kinematics between 90° direction side step cutting (SSC). SSC maneuver consist of jump, stop and twist the body and move side way. This study was performed on the hypothesis that smaller maximum knee flexion and larger knee valgus in left knee.

Subjects and Methods: 22 female collegiate female athletes participated in the study. Their average age, height, weight, length of career as basketball players was 21.0 years, 164.1 cm, 57.0 kg, and 6.0 years respectively. Motion of each subject during 90° SSC was recorded by 6 high-speed (200 frames/s) CCD camera system (Ditect, Japan) and 3D analyzed with knee kinematics. Each subject performed 5 trials and average changes of knee joint angle were calculated. All subjects were right dominant legs and they kick the ball with right legs. The statistical analysis was performed using ANOVA compared with dominant vs. non-dominant leg with knee flexion angle and knee valgus angle. The level of statistical significance was $p < 0.05$. This study was approved by the institutional review board (No.1335).

Results: The result showed bimodal curve of peak knee valgus in both knees. Maximum flexion occurred at stop phase after contacting subjects' leg on floor, and maximum valgus occurred almost simultaneously. In left leg, maximum knee flexion angle was lower by approximately 5 degrees than right leg. On the other hand, knee valgus angle was higher by 2 degrees. The significant difference of angular change between both knees was showed ($p < 0.05$).

Conclusion: There was significant difference between left and right leg. The lower flexion and higher valgus angle were observed in left knee. It is unknown whether the result of this study may be connected to higher incidence of ACL injuries in left legs compared with those in right legs. Further research with more subjects is necessary to clarify the cause of the results of this study.

31. Effects of taping to restrict knee valgus movement during single leg landing

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Keywords: taping, ACL and MCL injury, knee joint movement

Introduction: Anterior cruciate ligament (ACL) and medial collateral ligament (MCL) disruption is one of the most common injuries during sports activities. Taping is used to prevent the recurrence of ACL and MCL injuries for athletes. In previous studies, a knee arthrometer has been used to measure knee joint movements. However, the effects of taping to prevent a considerably common knee joint ligament injury time sequence changes remain unclear. This study focused on valgus angle of the knee joint, which is one of the risks of knee ligament injury, and aimed to investigate whether there were differences in time sequence changes in knee joint movement restricted by using the tape.

Methods: The participants were 18 female students with no history of knee injury. The task movement was a single leg landing from a 30cm height platform. Three-dimensional motion analysis system (Vicon Motion Systems, UK) and a force plate (AMTI, USA) were used to record the movement of three times for each participant, with and without taping. The taping method restricting for knee valgus involved X pattern and vertical taping for the medial collateral ligament of the knee using 50 mm width elastic tape (Nitto Medical Corporation, Japan). Based on the obtained marker coordinates and force plate data, Body Builder software (Vicon Motion Systems, UK) was used to calculate knee joint valgus angle, flexion angle, knee joint valgus moment, flexion moment and vertical ground reaction force. For statistical analysis, paired student's t-tests were performed for each item with and without taping. The significance level was set at $\alpha < 0.05$.

Results: The knee valgus angle of time sequence changes also significantly decreased with taping compared to without taping ($p < 0.01$). Compared to the values without taping, foot contact and maximum knee valgus angle significantly decreased with taping ($p < 0.01$). Maximum knee valgus moment also significantly decreased with taping compared to without taping ($p < 0.05$). There were no significant differences in other items.

Conclusion: Knee valgus angle and moment reduction were possible by using the tape restricted knee valgus. Restricting knee valgus movement was the superficial layer of the MCL and ACL of the knee. The tape may have supported ligament function. This is why the tape used to restrict knee valgus in this study was effective on the time sequence changes.

32. Motion characteristics of the thoracic, lumbar, and pelvic movements during trunk extension in the standing position in athletes

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Keywords: trunk extension movement, lower lumbar spine, collegiate athletes

Introduction: In athletes, low-back pain is one of the most common injuries. One of the causes of low-back pain is the large movement of the lower lumbar spine in competitive behavior. In swimming particularly, the extension movement between L5 and S1 is considerably large. Therefore, many swimmers complain of pain in the lower lumbar spine.

Trunk extension movements in the standing position have been observed for evaluating low-back pain. During the extension movement in the standing position, in normal adults, the lumbar extension movement is followed by the posterior tilting of the pelvis. However, in athletes, the pelvic tilting angle is hardly changed, and the lower lumbar extension movement is large (Obayashi et al., 2007). The movement of the lower lumbar spine during an extension movement in the standing position is closely associated with the thoracic spine, upper lumbar spine, and pelvis. Thus, not only the pelvis and lower lumbar spine but also the thoracic and upper lumbar spine should be analyzed to acquire the trunk extension movement with less load on the lumbar spine.

The aim of this study was to analyze the difference in the trunk extension movement between large and small lower lumbar extension movement angles.

Methods: Thirty-one athletes (16 men, 15 women) participated in this study. Changes in the thoracic spine, upper lumbar spine, lower lumbar spine, and pelvis from the standing position to the trunk extended position were measured by using Spinal Mouse (Index, Inc.). The athletes were divided into two groups. Sixteen (eight men, eight women) whose lower lumbar extension angle was large into the large group, and fifteen (eight men, seven women) with a small angle into the small group. They were compared.

Results: The lower lumbar spine angle in the trunk extended position was 26.6° in the large group and 15.4° in the small group. In the small group, a significant correlation was observed of the lower lumbar spine angle with the variation in the upper lumbar spine angle ($r = -0.64$, $p < 0.05$) and that in the pelvic angle ($r = 0.53$, $p < 0.05$). In the large group, a significant correlation was observed between the lower lumbar spine angle and variation in the pelvic angle ($r = -0.52$, $p < 0.05$).

Conclusion: During the trunk extension movement in the standing position in athletes, the load of the lower lumbar spine can be reduced by greater movement of the upper lumbar spine and pelvis.

33. Assessment of muscle contraction features by using Tensiomyography

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Keywords: tensiomyography, muscle contraction, gender difference

Introduction: Muscle strength is generally assessed using a hand held dynamometer and an isokinetic dynamometer. While these dynamometers provide a quantitative assessment of skeletal muscles, qualitative assessment is difficult. It is important for the physical therapist to assess not only muscle strength but also the physiological characteristics of skeletal muscles. Tensiomyography (TMG), a new method to assess features of skeletal muscles contraction non-invasively and selectively, has emerged in recent years. TMG provides information about the skeletal muscle contraction speed, stiffness, muscle fiber type, and muscle fatigue (Rusu et al., 2013). There is a correlation between the strength and muscle cross-sectional area, however it is unclear about the relationship between TMG and muscle strength. This study aimed to define the correlation between isokinetic knee muscle strength and the features of quadriceps and hamstring muscles contraction using TMG and to evaluate the gender differences in the variables measured by TMG.

Methods: 6 male and 6 female with no history of orthopedic disease in the lower limb participated in this study. In all the participants, the parameters of the left knee quadriceps and hamstring muscles were measured. Isokinetic muscle strength was measured at 60 and 180 deg/s with BIODEX System 3 (Biodex Medical Systems, USA). The measurement of the maximal displacement of the muscle belly (Dm) and the contraction time (Tc) were obtained using TMG for the following muscles: rectus femoris (RF), vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF), and semi-tendinosus (ST). Correlation between muscle strength and muscle TMG variables was analyzed using Pearson correlation coefficients. Additionally, sex differences in muscle strength and TMG variables were analyzed using an independent t-test. The significance level was set at $p < 0.05$.

Results: Correlation: There was no significant correlation between the isokinetic muscle strength and the TMG variables of each muscle in both male and female.

Gender difference: Male showed significantly higher isokinetic muscle strength than female. However, there were no significant differences in Dm and Tc of each muscle.

Conclusion: TMG provided values different from isokinetic muscle strength. It is important information from a physiological perspective to visualize the state of muscle contraction. In addition, TMG would help in prescribing training exercises, thus increasing the efficiency of rehabilitation in athletes and the elderly, by providing an objective measure of the features of muscle contraction.

34. Study evolution of noncontact anterior cruciate ligament injury mechanism

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Keywords: anterior cruciate ligament injury, basketball, sidestep cutting maneuver, biomechanics, kinematics

Introduction: Non-contact anterior cruciate ligament (ACL) injuries commonly occur during stopping, landing, and cutting maneuvers during basketball drills and competitions. Changes in running and landing availability can influence muscle's function and knee load that may cause ACL disruptions. Few studies have attempted to quantify the kinetic and kinematical parameters related with landing technique during sidestep cutting maneuvers using different running techniques. The objective of this study was to evaluate the effects that midfoot and rearfoot running techniques have on lower extremity biomechanics and kinematics during the deceleration phase of sidestep cutting maneuvers.

Methods: Thirteen healthy female collegiate basketball athletes performed sidestep cutting maneuvers with either a midfoot or rearfoot running technique randomly; biomechanical variables of the non-dominant leg were analyzed during the deceleration phases of the sidestep cutting maneuvers. Variables differing between sidestep cutting maneuvers using forefoot or rearfoot running techniques were compared.

Results: Participants presented increased peak knee valgus angle, peak knee flexion angle and peak hip flexion angle during the deceleration phase of sidestep cutting maneuvers using rearfoot running technique, compare to midfoot running technique ($p < 0.05$). However, at the initial contact with force plate, participants presented increased knee adduction moment during sidestep cutting maneuvers using midfoot running technique ($p < 0.05$).

Conclusion: In summary, the observed biomechanical differences between sidestep cutting maneuvers using different running techniques suggest that the running technique present different characteristics and that the injury mechanism may depend on the combination of running technique and the specific movement. Rearfoot running places female basketball athletes in a more valgus knee position, which can potentially place a higher strain on the ACL. Therefore, midfoot running technique may be targeted in ACL injury prevention programs.

35. Association of verbal abuse and physical violence from coaches with joint and limb pains of children engaged in junior club sports activity- a cross-sectional study

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Keywords: children's sports injury, verbal abuse, physical violence

Introduction: Psychosocial factor is one of the common etiologic factors that lead to sports injuries. In Japan, verbal abuse and physical violence from coaches have been a long lasting issue that resulted in psychological distress and burdens for many children engaged in sports activity. We hypothesized that joint or limb pain at multiple sites of children engaged in regular competitive sports activities may be associated with verbal abuse and physical violence from coaches.

Methods: A cross-sectional survey for children engaged in regular competitive sports activities registered in Junior Sports Clubs in Miyagi Prefecture in year 2013 was conducted. Out of 26,069 eligible members, 5,560 participated in the questionnaire survey. The questionnaire was used to assess the presence or absence of joint and limb pains with their location and duration. Inquiry for whether they or their colleagues have experienced verbal abuse or physical violence from coaches was included together with potential confounding factors such as their age, sex, BMI, grades, the competition level of the team, weekly frequency of activity, daily duration of activity, subjective perception of toughness or hardship of regular activities, if they had appropriate time for breaks, and if they had someone who could ask for advise. Multiple logistic regression analysis was used to examine the relation between pain at two or more sites and the experience of verbal abuse and physical violence from coaches.

Results: The number of children with pain was 1,463 (26.3 %), and the number of children with pain at two or more sites was 803 (14.4 %). The numbers of children who experienced verbal abuse or physical violence from coaches were 1,213 (21.8 %) and 713 (12.8 %), respectively. As compared with children who received no verbal abuse from coaches, children who experienced verbal abuse had higher odds of having pain at two or more sites (Odds Ratio[OR] = 1.39, 95 % confidence intervals [95%CI] = 1.16-1.66, P < 0.001). As compared with children who experienced no physical violence, children who experienced physical violence had higher odds of having pain at two or more sites (OR = 1.32, 95%CI = 1.06-1.65, P = 0.013).

Conclusion: The experience of verbal abuse or physical violence from coaches was positively associated with the presence of pain at multiple joints and limbs.

36. Repatriation of patients with winter sport injury

Peter Felkai, MD, PhD

Hungary hasn't got any high mountains which satisfies the needs of the winter sport enthusiasts. Yet, 700,000 ski-fan exist in the country. Their destinations are the snow-sure slopes abroad. The combination of the long journey and the missing physical fitness often results in an accident in the first days of the journey. Since the skiers are suffering these accidents abroad, they are unable to return home on their own. Consequently they have to be repatriated.

The author of the presentation describes the epidemiology of these kind of winter sports related accidents. It is reasonable to explain these because of the frequent repatriation of the Hungarian (and probably the eastern-european) sportsmen.

The medical indication, statistic and the process of the repatriation of the patients with winter sport injuries are also reviewed.

37. The investigation into availability of the new leg-dynamometer

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Keywords: muscle strength measurement, knee extensor muscle, skeletal muscle mass

Introduction: The muscular strength of the quadriceps femoris muscle is essential for many athletes. In these days, it becomes more and more important to evaluate a physical function in medical care and rehabilitation. The purpose of this study was to examine the availability of new leg-dynamometer (Locomo Scan; LCS, ALCARE Co., Ltd., Japan) by analyzing repeatability of LCS and the correlation of muscle strength between LCS and Cybex dynamometer, and, compared muscle strength to skeletal muscle mass.

Methods: 105 healthy volunteers (aged 19.9 ± 1.9 years) participated in this study. The muscular strength measurement of the isometric contraction of knee extensor muscle was performed by LCS and Cybex. Skeletal muscle mass was measured using a body composition analyzer, InBody (Biospace Co., Ltd., Korea). The SPSS software program (SPSS 12.0J, SPSS Japan) was used for the statistical analysis and Pearson's correlation was used to determine a level of significant of less than 5 %.

Results: The mean muscle strength measured by LCS was 629.0 ± 171.3 N and 643.4 ± 169.8 N in the first and second trials, respectively, with a significant correlation ($r = 0.90$, $p < 0.0001$). Further, there were significant correlations between muscle strength measured by LCS and Cybex ($r = 0.81$, $p < 0.0001$) and between the muscle strength and skeletal muscle mass ($r = 0.77$, $p < 0.0001$).

Conclusion: Similar to Cybex that was used in previous studies, LCS is a valid and reliable instrument for measuring muscle strength. Further, LCS is easy to operate and to carry around. Thus, LCS may be used as a simplified leg-dynamometer in clinical situations.

38. Snow sport injuries in a ski resort.

Our experience during 24 consecutive seasons

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Introduction: Snow Sport techniques are constantly evolving and the preparation of the slopes is experiencing changes. In our Ski Resort Snowboarding population and associated injuries exploded in 1994. On the other hand, since 1997 Conventional Alpine Skis have been progressively changed. An observation of changes in the snow sports injury pattern prompted us to conduct a descriptive analysis of 24 consecutive seasons.

Methods: Since 1992 we have been collecting data in Baqueira Beret Medical Center in the Pyrenees. More than 60,000 snow sport injuries have been registered. We have analyzed the probability of injury for ski and snowboard, gender, age, diagnosis, collisions, as well as the evolution of certain types of injuries through the years.

Results: The probability of injury per thousand skier days has been 2.4 for Skiing and 5.3 in Snowboarding. 52.48 % of Downhill skiers were male and 47.89 % female while in Snowboarding 69.04 % were male and 29.92 % female. The mean age for downhill skiers was 34.8 yrs. old and 27.5 for snowboarders. In downhill skiing, 2 pathologies represent 51 % of total injuries (knee ligaments and upper extremity contusions) while in snowboarding wrist fractures and upper extremity contusion represented 49 % of total injuries. Collision data has been collected since the year 2000 with a total of 3,000 collisions related injuries. The probability of having an injury due to a collision was 5.73 % in the present study. Parabolic skis were introduced in 1998 in our ski injury data and have progressively substituted convention alpine skis. The first snowboard injuries recorded were in 1995. Skiboards, Cross-country and Freestyle data has also been gathered. Knee ACL injuries, lower leg fractures, wrist fractures, shoulder dislocations and skiers thumb have been analyzed and the evolution of these diagnosis throughout 24 ski seasons will be more thoroughly discussed.

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39. Evolution of knee ligament injuries in winter sports

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Keywords: Winter sports, trend, injury, alpine skiing, Medial Collateral Ligament, Anterior Cruciate Ligament

The author describes winter sports injuries evolution in France over a period of three decades. The data was collated by 47 medical doctors based in 32 French resorts who form part of a working group from French association Medecins de Montagne. These doctors, all working at the bottom of the slopes, treat an estimated 20, 000 injuries per winter season.

The aim of this paper is to look at the trends in overall incidence of injuries together with the trends in the incidence of knee injuries in the French ski resorts since 1992.

This is a prospective cohort study. The study group includes 419,809 injuries since 1992.

Sampled values for overall risk of injuries are calculated in MDBI (mean days between injuries). The other ratio use is the incidence per 1000 skier days. There thus appears to have been an increased risk from 1992 up until 2005, with a subsequent reversal of the trend between 2005 and 2014. This reversal of the trend is explained by the change in the incidence of risk of snowboard injuries, with that of skiing remaining stable.

The most common injuries seen in alpine skiing is knee sprain representing more than 35 % of all skiing injuries. Moderate knee sprains are more common for beginners while ACL isolated are more common for intermediate and advanced skiers. For alpine skiing, the risk of ACL rupture is 2.5 times more common in women over the age of 25 than in men. The overall incidence of ACL pathology has remained stable since 2000 but not that of MCL pathology. This stability of ACL injury follows a period of increasing incidence between 1992 and 2000.

During the same period, the risk of lower leg fractures and ankle fractures have significantly increased, following a period of stability.

The larger risk for a severe knee injury concerns a female using a material not properly set beginning in alpine skiing when not practicing other sports activities in current life.

40. ACL injuries in alpine skiing and the principles that apply to their prevention

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Introduction: Injuries to the anterior cruciate ligament (ACL) in the knee in alpine skiing should be largely avoidable with bindings that are properly designed, manufactured and adjusted. Just as spiral fractures of the tibia have been nearly eliminated by advances in binding technology in the 1970s, so could ACL injuries be largely in the next decade. ACL injuries have been the most common serious injury in skiing for three decades. The cost of medical expenses and lost work every year due to ACL injuries in skiing have been estimated to be over a billion dollars per year. An alarmingly high percentage of top level alpine ski racers have suffered ACL injuries. The ski specific mechanisms for ACL injuries and the understanding required to design equipment to prevent them, have been known for decades. The understanding of how to properly adjust bindings to respond appropriately to the specific loads that could cause ACL injuries has been developed more recently (Howell 2014).

ACL injuries in Skiing: ACL injuries were relatively infrequent through the 1970s. In the late seventies, when alpine skiers started using boots that were better at transmitting loads between the posterior portion of the lower leg and the tail of the ski, ACL injuries increased.

Crane in 1977 noted an increase in ACL injuries that he attributed to increasing stiffness of the boots and proposed the boot induced anterior drawer (BIAD) mechanism. This ACL-injury mechanism occurred in backwards falls where a load on the tail of the ski rotated the boot forward, forcing the tibia forward relative to the femur. A presentation to the International Society for Skiing Safety in 1983 documented an exponential growth in ACL injuries beginning in the late 1970s.

ACL injury mechanisms in addition to BIAD have been described since 1983. These have gone by several names, including, phantom foot, click-clack, slip-catch and dynamic snowplow. They all have combined valgus and inward rotation (CVIR). The inside (medial) edge of the ski can be loaded behind the heel to produce CVIR. It is, perhaps, the most common kind of ACL injury mechanism in skiing.

Principles of prevention - ski bindings: Alpine ski bindings have two basic functions. The first is to reliably transmit control loads from the skier's boot to the ski, which includes providing retention against inadvertent release (IR). The second is to avoid transmitting injurious loads from the ski to the skier. There is a region in the load space above the loads needed for retention/control and below the loads that could cause injury where the binding should respond to mitigate loads. The loads to the ski that will cause different types of injury depend on where and in what direction the load is applied to the ski. The load space can be imagined in three dimensions. There are two surfaces representing the position, direction and magnitude of the loads between the ski and the snow. An outer surface describes an injury envelope and an inner surface describes a retention/control envelope. Both envelopes can be imagined surrounding a ski on which the position of the loads is shown, as proposed by Bahniuk (1975). Between these two envelopes one can imagine a response surface for the binding. If the binding response surface pierces the injury or the retention/control envelope, then an injury or an IR would result from a load of that magnitude at that position.

Protecting the ACL: A number of equipment modifications have been proposed to mitigate ACL injuries including: reduced ski-shaping, reduced stand-height; and a reward release boot (Lange RRS).

Other interventions include the ACL Awareness Program for how to fall to avoid CVIR (Ettliger, Shealy Johnson), and the physiology program that improves skiing proprioception (Westin). The first three have the potential to adversely influence the skiing experience and the latter two, while dramatically reducing ACL injuries in ski patrollers and racers, require special training. The binding is favored as a solution to the ACL injury epidemic because it is a passive solution that can avoid influencing the skiing experience, and the binding has been shown to be highly successful in reducing tibial fractures.

Conventional heel-toe bindings respond to lateral loads on the ski by allowing rotation of the ski about a point on the ski which is a projection of the tibial axis. This works well for responding to loads that would cause spiral fractures of the tibia, however it is largely unresponsive to loads that cause CVIR ACL injuries. A binding has been commercialized with a heel unit that incorporates lateral release, like the toe, so that it can respond to loads that could cause CVIR ACL injuries, with a rotation point near the toe, while avoiding IR (Howell 2003). There is a plan to re-introduce this binding with ISO compliance and improved ACL injury mitigation (Howell 2015).

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41. Ski bindings and the mitigation of ACL rupture

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Keywords: skiing ACL rupture, valgus moments, abduction forces, lateral heel release, 3-mode ski bindings

Introduction: Abduction forces applied to specific positions on the medial edge of a ski can produce valgus-moments and tibia-torques that cause ACL-rupture (and/or MCL-rupture) before tibia-fracture. 2-mode ski bindings with lateral toe release and forward heel release cannot release in response to these specific applied abduction forces before ACL-rupture, whereas 3-mode bindings with additional lateral heel release can release below ACL-rupture.

Methods: A ski is rigidly-affixed to a metallic foot-tibia-femur test-frame system that provides the basis for simulating skiing-ACL-injury kinematics. Initially, no ski-binding is utilized. The proximal end of the femur is rigidly attached to the test frame as during maximal internal rotation of the hip. Abduction forces are applied to a range of positions along the medial edge of the ski while measuring the peak valgus-moments and peak tibia-torques at ACL-rupture according to a validated ACL-rupture algorithm* of an average U.S. male that interacts valgus-moments, tibia-torques and ACL-strain. The peak applied abduction force (as a function of position along the length of the ski) is also measured at ACL-rupture. 2-mode and 3-mode bindings are then interposed into the test protocol to quantify the interaction of these two types of bindings relative to ACL-rupture and relative to tibia-fracture.

Results: Independently of ski-bindings — due to the combined leverage of the ski and the tibia-shaft — abduction forces can produce ACL rupture before tibia-fracture when applied to a ski between -70 cm and -20 cm aft of the projected axis of the tibia at peak magnitudes ranging from 155 N to 200 N (21 % to 27 % of average U.S. male body weight); whereas tibia-fracture is produced when abduction forces are applied to a ski aft of -70 cm from the tibia-axis (not shown, below). 3-mode bindings release below the rupture-limit of the ACL; 2-mode bindings cannot (see below).

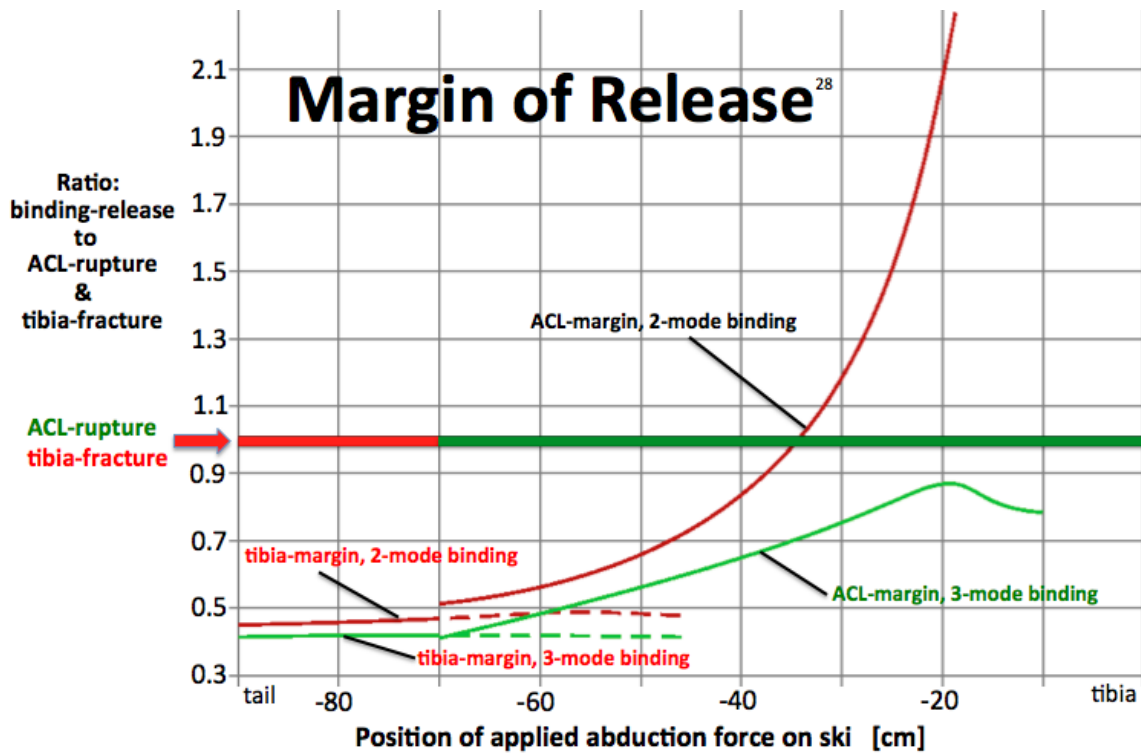


Figure 1. Ratio of binding-release to ACL-rupture & tibia-fracture as a function of position of applied abduction force.

Discussions and Conclusion: Abduction-forces applied to the medial edge of a ski can produce tibia-fracture or ACL-rupture, depending upon the magnitude and the position of the force. 3-mode bindings with additional lateral heel release appear to release below the ACL-rupture limit when specifically tuned in the 3rd-mode.

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42. Training and rehabilitation for preventing knee ligament injuries

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Keywords: ACL injury, alignment of lower extremity, side step cutting

Function trainings to activate neuromuscular control systems are common in order to connect them to unique movement for each sport. However, it is also natural to regard muscular strength and flexibility as important. Needless to say, it is important to prevent sports injury, especially anterior cruciate ligament (ACL) injury. Recently various prevention trainings have been developed and implemented to achieve these objectives, which may decrease risks for injuries and incident rates of these injuries.

Authors believe that acquisition of appropriate alignment of lower extremities is essential for safe sports movement with low risks of injuries. Today's lecture is to introduce an analysis of sidestep cutting and lateral jump-and-landing, which are considered as high-risk movements of ACL injuries. This analysis can help us to clarify changes of alignment of lower extremities and existence of risks of ACL injuries.

Methods: Female college students without history of knee injuries participated in this study. This study was approved by the ethics committee of Graduate School of Biomedical and Health Sciences (ID: 1428). Each subject performed sidestep cutting and lateral jump-and-landing maneuvers. Movement during trials was recorded by the three dimensional motion analysis system and floor reaction force gauge. Duration of analysis was set from the time of foot contact through the time when the knee joint angle became max.

Results: During sidestep cutting, there was a tendency that as knee flexion angle increased, varus angle also increased. In addition, interestingly the maximum knee flexion angle is less and the maximum knee valgus angle was more in left legs compared with right legs. During lateral jump-and-landing, the angle of knee joint on the opposite side became varus on landing and reached to 7° at max. The knee joint on the jumping side was valgus and average angle of the knee joint was 5°. The knee flexion angle was more in the opposite side of jump compared with the other throughout the duration of analysis.

Conclusion: Results of this study showed that laterality of knee angle might exist during sidestep cutting, however we can't determine that due to small sample size. It is supposed that knee joint of opposite side showed higher valgus angle during lateral jump-and-landing maneuvers. In addition, it should be noted that knee angle of the jumping side was also valgus on the contact phase. It is suggested that a risk of ACL injuries may exist not only opposite side but also jumping side during lateral jump-and-landing.

43. Mitigating knee injuries through material

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Introduction: Means to mitigate knee injuries through ski equipment materials are presented and discussed. There are important potential means of mitigating knee injuries, especially in binding function. Medical costs due to knee injuries in skiing could be reduced by hundreds of millions of dollars per year. It is difficult to understand why this is not already being done. Material solutions to the knee injuries were presented as early as 1983. Material solutions to mitigating knee injuries exist and should not be categorically ignored.

State of the art in injury mitigation: In situations where hazards cannot be eliminated, then the transmission of the hazard should be interrupted before it can do harm. The ski-boot-binding system can transfer potentially injurious loads to the skier. Historically, as the boot and binding developed to improve transmission of control loads in skiing, mechanical features in the binding were developed to prevent the transmission of potentially injurious loads. In the 50s and 60s spiral fractures to the tibia were mitigated by bindings and related release-settings that provided a lateral release of the boot toe. As boots developed more stiffness in the forward bending direction, bindings and related release-settings were designed in the 60's with upward release of the heel to mitigate bending fractures of the tibia. Bindings that provide only these two modes of release are the most common in use today.

In the early 70s, as boots became stiffer in backward lean and knee injuries increased. A skiing specific ACL injury mechanisms were presented over three decades ago, the boot induced anterior drawer (BIAD). Many bindings have had the capacity to address BIAD type injuries by vertical release at the toe of the boot (e.g., Spademan, Besser, Gertsch, Geze SE3). Inadvertent release (IR, aka pre-release) has been an issue that can be exacerbated by extra release functions. The Lange RRS boot also addressed BIAD mechanisms. However none of these bindings or the RRS is currently on the market.

In the 80s combined valgus and inward rotation (CVIR) became recognized as the predominant mechanism of knee injuries in skiing. CVIR encompasses situations that have been called phantom foot, slip-catch, valgus collapse, dynamic snowplow and click-clack. In 2003, Hagemeister and Chevalier showed how a third mode of release, lateral at the heel, could address valgus-dominant skiing knee injuries. In 2003, Howell filed a patent and produced a practical 3-mode binding that could address valgus-dominant knee injuries in skiing, while mitigating inadvertent pre-release (US patent 7,318,598). Similar protection could theoretically be provided by a lateral shearing plate-cam device between the binding and the ski (Madura and Brown 2015).

Protect the ACL with a binding or plate: The most common and important mechanism for injuring the knee in skiing is CVIR. This valgus dominant combination of loading has been shown to rupture the ACL (Hagemeister and Chevalier 2003, ISSS Pontresina; Howell 2005, ISSS Arai; Shin et al. 2011). These events can generate a large lateral load on the inside of the ski just behind the heel. A 2-mode binding is not sufficiently sensitive to this loading condition that causes only a small inward torque about the tibia shaft. This load does however apply a valgus load to the knee combined with inward rotation. In normal skiing there can be relatively large loads for turning at this location,

however the direction is predominantly normal to the base of the ski. A dangerous lateral component of the load can occur when there change in terrain or the skier lands after a bump. The boot holds the tibia forward and keeps the skier from contacting the snow thereby transmitting the CVIR to the knee. To prevent the transmission of a load with a potentially injurious lateral component, a binding or plate can allow the heel of the boot to move and release laterally.

Testing and adjustmen: A product can be no better than its testing (Howell, lecture at WPI 2013). The response of a 3-mode binding or shear plate to CVIR needs to be adjusted measured and controlled for appropriate functioning (Howell 2005). Hagemeister and Chevalier (2003) and Shin et al. (2011) provide the biomechanical evidence required for adjusting the lateral release on a 3-mode binding. Howell (SITEMSH Flachau 2015) has developed means for testing and adjusting 3-mode bindings.

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44. Pathomechanics of ankle injuries in skiing

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Keywords: biomechanics, ankle injury, skiing

Objective: Our objective is assessing stability and mobility function and mechanics of ankle in a ski turn. Skier's performance is governed by proper muscular, joint and skeletal actions of the body during the execution of a given task, skill and/or technique. Structural limitations, training deficiencies or **equipment error may induce poor performance and lead to injury in Skiing.**

Joint Kinematics: Ankle dorsiflexion is critical to stance and balance on a stable turning foot in a ski boot. Dorsiflexion induces pronation and leg rotation. This combination of forces controls the edge angle. Edge angle is increased by pronation per se enhance pressure on the inside (medial) aspect of the foot. The ankle joint is also a source of sensory feedback and the role of ligaments and the plantar aponeurosis is important.

Skier's Boot: The incidence of injury decreases with the innovation of safety measures of the skiers boots in the form of releaseable bindings and hard shell in Alpine Skiing.

"Snowboarders ankle," a fracture of the lateral process of the talus, caused by forced dorsiflexion and inversion at the ankle induced by softer boots. Hard boots place the snowboarder at risk for "boot-top" fractures of the tibia and fibula as well as double the risk for knee injury

Muscles & ligaments; action of the Gastrocnemius and Soleus muscles include flexing the leg at the knee joint and the development of tension is fundamental in skiing. The Soleus plays a main role in maintaining standing posture. Ankle Invertors and Everters help to preserve good medial and lateral alignment. Ankle Dorsiflexors are most active during short turns and bump skiing.

Conclusion: Further investigation on specific biomechanical aspects of the different strategies is necessary. Future research on relationship between physiological variables, functional anatomy and modified equipment could reduce ankle injury in Skiing.

45. Kinematic errors leading to ski injuries

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Keywords: ski injuries, alpine skiing, snowboard, carving

Objective: To evaluate the main mechanisms of injuries in Alpine skiing and also snowboard based on video analysis reported in related studies. Moreover, considerable changes in equipment design and movement pattern have been occurred in recent years. Therefore, assessing about the alteration of rate and type of injuries based on these developments will be done.

Alpine Skiing: There are three main mechanisms result in anterior cruciate ligaments injuries among elite alpine skiers. Slip-catch, landing back-weighted and dynamic snowplow. In Slip catch mechanism the skiers lost pressure on the outer ski .Therefore to regain their balance, the inside edge of outer ski caught abruptly in the snow and forced the knee into internal rotation and valgus. The similar pattern was observed in dynamic snowplow. However, the landing back-weighted category was observed in ski jumpers out of balance backward on ski tail with extended knee.

Snowboard skiing: Little is known about the mechanisms of injuries in snowboard cross. The principle cause of injuries –based on systematic analysis- was a technical error at take-off leading to a too high jump and flat-landing. For instance the injured rider lands flat and leaning backward – subsequent error in mechanism of previous jump - is unable to recover resulting in unbalanced posture at take-off on following jump.

New technique of turn: A different form of turn named "carve". It is based on the new shape of ski. Starting the carve turn simply necessitates the ski to be rotated onto its edge and completed through small movements of the hips and knees. This technique is safer and faster and brings good feeling for skier.

Conclusion: It could be possible to train athletes to recognize the mechanism of injuries to avoid these situations. After developed their awareness and also the program training, reducing the risk of injuries will be occurred.

46. Knee kinematics during lateral-jumping and landing in female

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Keywords: side-jump landing, anterior cruciate ligament, knee joint movement

Introduction: Anterior cruciate ligament (ACL) injury can occur during jumping and landing because of combination of a small knee flexion angle and a large valgus angle (Timothy et al., 2006). However, it is not clear the knee movements of lateral-jumping and landing. To prevention ACL injury, it is necessary to analyze the knee movement during lateral-jumping and landing. The purpose of this study was to clarify the kinematics of the knee joints during lateral-jumping and landing.

Methods: Eleven college females without a history of knee injuries participated in this study. Each participant jumped laterally as the maximum effort and touching the ball that set at their highest vertical jumping points with their hands. The direction of each jump was indicated to right. The movement during each trial was recorded using a three dimensional motion analysis system and two force platforms. Angular displacement of knee joint was analyzed each movement from the initial contact of foot on the plate to the maximum angle of knee flexion was achieved. Knee joint kinematics data were averaged of three successful for each subject. Student's paired-T test was used for analyzing the differences in knee flexion and valgus angles between both lower extremities. The significance level was set at $p < 0.05$.

Results: All participants firstly landed on the left leg after jumping to the right. The knee flexion angle of both legs were similar at the initial contact (right is 20.8 ± 5.1 and left is 21.3 ± 7.7); however, the maximum knee flexion angle was found to be greater in the left leg (right is 84.5 ± 11.1 and left is 66.8 ± 12.7 ; $p < 0.05$). The knee valgus angle was significantly greater in the right leg at initial contact (right is 4.0 ± 5.1 and left is -6.1 ± 4.5 ; $p < 0.05$), whilst the left leg showed varus position at its initial contact.

Conclusion: In this study, the knee joint kinematics during lateral-jumping and landing was analyzed. The right leg showed a smaller knee flexion angle and a larger valgus angle in deceleration phase after landing to right side. The knee position which combines a slight flexion and extremely large valgus during landing is emphasized to be a risk of ACL injury (Tietz et al., 2001). Thus, the right leg, same side limb with direction of jumping may be exposed to a higher risk of ACL injury.

47. Difference in vertical ground reaction force between dominant leg and non-dominant leg at quick stopping motion

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Keywords: anterior cruciate ligament (ACL), ground reaction force, stop movement

Introduction: Excessive vertical ground reaction force (vGRF) is reported to be risk factors for anterior cruciate ligament (ACL) injury (Shimokochi et al., 2013). ACL injury is a serious injury that occurs quick stopping maneuver during sports activities. Iwata et al. (2015) reported that the valgus angle of the knee joint during the stopping phase of side step cutting was significantly greater in the non-dominant (left) leg than in the dominant leg.

Additionally, ACL injury has been reported to occur more in the non-dominant (left) leg (Urabe et al., 2002). However, the difference in the magnitude of vGRF between the dominant and the non-dominant legs when movement is vigorous stopped is unknown. This study verified the difference in the magnitude of vGRF between the dominant and the non-dominant legs when movement is vigorous stopped.

Methods: Six healthy women (20.6 ± 1.2 years, 160.5 ± 7.1 cm, 51.0 ± 4.1 kg) without orthopedic diseases in this study. The dominant (= kick the ball) leg with participants was all of right leg. The task behavior was to stop movement. The participants tread with full force at a force plate (AMTI, Inc.), whose distance from the start line was 50 % the height of each participant, and held the other leg stationary. This task was performed 10 times using the dominant and non-dominant legs. The analysis was performed from initial contact until the peak vGRF was attained. Initial contact was detected when vGRF exceeded 20 N. The resulting peak vGRF was normalized by body weight, and the average value of each trial for the dominant and non-dominant legs was calculated. The statistical analysis was conducted using Excel Statistics 2010 for Windows (SSRI, Inc.). Paired t-test was used to compare the difference between the dominant and non-dominant legs. The significance level was less than 5 %.

48. Relationship between Functional Movement Screen™ (FMS™) and physical assessment by gender in the healthy adults

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Keywords: FMS™, clinical physical function test, healthy adults

Introduction: It is necessary to understand the mechanism of injuries and the risk factor of traumatic injury and disorders based on the traumatic prophylaxis. In addition, it is important in the prevention of traumatic injury and disorders may present measures to improve early detection of problems and the cause of an injury and disability. Recently, a tool to assess fundamental movement, Functional Movement Screen™ (FMS™), has been described by Cook et al. (2006). To determine whether relationships truly exist between core stability and performance, functional movement and individual components of performance, including power, strength, and balance, must be assessed. However, relationships between these variables by gender have not been established. This study aimed to clarify the relationship between Functional Movement Screen™ (FMS™) and physical assessment by gender.

Methods: A sample of 28 volunteer students (male : female = 16:12) from Hiroshima University provided informed consent. Participants performed 7 assessments: FMS™, ankle range of motion (ROM) without weight bearing (NB) and with bearing (WB), functional reach test (FR), Y balance test (Y-test), trunk muscle strength and vertical jump. It compared the total score of FMS™ and the correlation between FMS™ and each assessment by gender, separately.

Results: There was no significantly of FMS™ between male and female. The correlation coefficients for the tests show a significant positive correlation between FMS™ and trunk flexor ($r = 0.59$, $p < 0.05$), and extensor muscle strength ($r = 0.71$, $p < 0.01$) in male, and NB-ROM (Rt) ($r = 0.69$, $p < 0.05$) and NB-ROM (Lt) ($r = 0.75$, $p < 0.05$) in female.

Conclusion: This study showed that positive correlation between total score of the FMS™ and physical assessment can be demonstrated males and females, separately. The moderate to strong correlation between FMS™ and trunk-muscle strength in males and between FMS™ and Ankle ROM in females were showed in this study. This study suggested that structural differences between males and females may lead to altered movement patterns that may contribute to this gender bias. FMS™ is not only used to evaluate quality of human movements and to find deficits in the body during dynamic movements that possibly cause injuries, but also FMS™ is a useful device to suggest the specific approach on improving physical function and preventing the traumatic injury and disorders. In conclusion, this study found that the FMS™ score was related physical assessment in male and female, separately. Further studies will be necessary to investigate the reliability of the device for the athletes.

49. A correlation between restriction of ankle dorsiflexion and the position of the talus using MRI

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Keywords: ankle sprain, restriction of ankle dorsiflexion, position of a talus

Introduction: Lateral ankle sprain or high ankle sprain occurs in the population of athletes who wear soft snowboarding boots. Recurrent ankle sprain affects athletic performance and prevents a return to sport. One of the risk factors for anterior knee pain and recurrent ankle sprain is restriction of ankle dorsiflexion at the talocrural joint. Green et al. reported that posterior mobilization of the talus improves ankle dorsiflexion. When the anterior talofibula ligament is torn, the talus becomes pushed forward as confirmed by the anterior drawer sign. However, few reports have investigated the causes of restriction. The purpose of this study was to evaluate the relationship between restriction of ankle dorsiflexion and the position of the talus using magnetic resonance imaging (MRI).

Methods: We examined the medical records of 83 outpatients who were diagnosed at our clinic with lateral ankle sprain between 2012 and 2014. The study included 28 patients who underwent diagnostic MRI scans. Data items were age, sex, and a restriction of ankle dorsiflexion range of motion for more than 3 weeks. Talus alignment and the ankle plantarflexion angle were evaluated with MRI (sagittal view). MRI parameters included: the extent of anterior displacement from the posterior lip of the tibia to the nearest articular surface of the talus (range), and the ankle plantarflexion angle. Data were divided into two groups for analysis, according to restriction of ankle dorsiflexion. The cutoff value and area under receiver operating characteristic curves (ROC) were calculated to predict ankle dorsiflexion limitation, using the range.

Results: There were no differences between the two groups in terms of age, sex, and ankle plantarflexion angle. The only significant between-group difference was in the range ($p < 0.001$). Using ROC analysis, the cut-off value for the range was 1.32, the ROC was 0.94 (0.85-1.02), the positive prediction value was 0.87, and the negative prediction value was 0.85.

Conclusion: Although each patient received conservative treatment and had fixation or an ankle brace before MRI scans, the talus was dislocated. Fixation should be reconsidered in the case of restricted ankle dorsiflexion. The results of this study indicate that anterior dislocation of the talus is always present in patients with a limited range of ankle dorsiflexion motion.

50. Characterization of vertical and posterior ground reaction force during single leg jump-landing with body rotation

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Keywords: ground reaction force, single leg landing, body rotation

Introduction: Lower extremity injuries such as anterior cruciate ligament injury and ankle fracture are common among athletes of snowboard and ski (Sakamoto, AJSM, 2008). Many of these injuries are caused by high landing impact after jump (Boon, AJSM, 2001; Valderrabano, AJSM, 2005). In the rehabilitation period required to return to their functional fitness level, the athletes train for jump landing with body rotation considering the characteristics of these sports. However, the characteristics of landing impact with body rotation are unclear. The purpose of this study was to examine the ground reaction force during single leg landing with body rotation and to obtain useful information pertaining to the impact absorption. Based on the obtained data, we can formulate strategies to prevent the lower extremity injuries during jump-landing.

Methods: Forty-four normal subjects (30 males, 14 females) participated in this study. All the subjects performed a single-leg jump landing task on a 20-cm high platform which were placed 60 cm from the center of the force plate (9260AA6, Kistler). The landing task comprised three techniques: anterior jump landing (AN) and anterior jump landing with 90 degrees body rotation (external rotation; EX, internal rotation; IN). The peak ground reaction force (vertical and posterior) and the time to peak ground reaction force data were analyzed using specific software (IFS-4J/3J, DKH). The data were analyzed with One-way repeated measures ANOVA to compare the main effect of jump landing tasks, wherein the independent variable was jump landing task while the dependent variables were the ground reaction force parameters; a priori α -level was 0.05. Data were analyzed with SPSS v. 21.0 (IBM Corp).

Results: During IN jump landing, the vertical ground reaction force were greater than during AN jump landing ($p = .011$); peak posterior ground reaction force were greater as compared to EX jump landing ($p = .029$).

Conclusion: The results of our study suggest that vertical and posterior ground reaction force tend to increase during single leg jump landing with internal body rotation. Therefore, to prevent lower extremity injuries caused by the landing impact among athletes, additional cares must be taken to reduce the ground reaction force during single leg jump landing with internal body rotation.

About “Yukimaji! 19”

Fumiko Kato

Principal researcher in JALAN research center, Recruit Lifestyle Co., Ltd.

"Yukimaji!19" is a service that over 190 ski resorts offer nineteen-year-olds people their lift tickets for free of charge during whole winter time.

The purpose of this project is to create more demand in snow activity markets, and to revitalize snow areas. Japan is a country with a lot of ski resorts.

The number of ski resorts is about 400-450 in Japan.

There is a ski area of about only 17 in Korea, neighborhood country.

In ski area, agriculture and forestry are popular as industry because there are a lot of mountainous regions. Winter is a slack season for agriculture and forestry, therefore people work for ski resorts during winter season. If ski resort suspended because of decreasing demand, there is a possibility that people can't find any more work during winter season.

It's opposite to the importance of the ski resort, in Japan, snow activity markets is decreasing for over 20 years.

Participation rates in snow activities decline as age increases. The key is to maximize the number of first-time participants. As a result of the questionnaire survey on the internet, the age of the typical first-time participant is the age of 19, new graduates from high school, mostly freshmen in college or university.

Hypothesis is that, "Making a debut in snowboarding at age 19" will directly lead to snow activities for years to come.

"Yukimaji! 19" is not a discount nor a deflation, it is a marketing scheme and strategy for the snow activity industry to bring in the beginners who are the most important clientele group.

In winter of last year, more than 150,000 19 years old have gone out to a ski area using this program. There are about 1,200,000 19 years old in Japan. So, it's more than 12 % of the population 19 years old.

Sunday, March 13th

7:30 pm - Welcome Dinner

The welcome dinner will take place in Tenkyo

Wednesday, March 16th

11:00 am – 1:00 pm Ski Competition

The ski competition will take place in **Grandeco Ski Resort** (not in Listel).

A shuttle bus to Grandeco Ski Resort departs at 8:30 am from entrance of Listel.

Please be careful not to be late.

Thursday, March 17th

8:00 pm - Gala Dinner

The gala dinner will take place in Tenkyo

◆ OPTIONAL TOUR (sightseeing in Aizuwakamatsu)

Aizuwakamatsu is located in the southeastern corner of the Aizu Basin, an area surrounded on all four sides by mountains. The basin lies in the western part of Fukushima Prefecture, which is the southernmost prefecture of the Tohoku region. Aizuwakamatsu is situated more or less equidistant from the Pacific Ocean to the east and the Japan Sea to the west. Summers are hot and humid, while winters are harsh, with snow depths averaging 30 – 50 centimeters. Owing to the climate and other reasons, Aizu has enjoyed high agricultural productivity and a rich cultural tradition since ancient times.

Aizu played an important role under the Yamato government around the fourth century. In subsequent centuries, Aizu was ruled by a succession of powerful warlords owing to its strategic location at the entrance to the Tohoku region. The unsettled period was followed by 225 years of stable rule by the Aizu Clan, starting from 1643, when the Matsudaira family received rulership of the fief from the Tokugawa Shogunate, a feudal military government, and lasting until 1868, when Tokugawa forces, which included Aizu, lost to the imperial faction in the Boshin War, a civil war fought over the opening of Japan to foreign nations.

Aizuwakamatsu is a tourist attraction now, and there are a castle and more. If you hope for tour not a ski competition on **March 16th**, we guide you. Please ask the staff for details!!

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Nozomi Suzuki

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Teresa Marti

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Shigeyo Shimada

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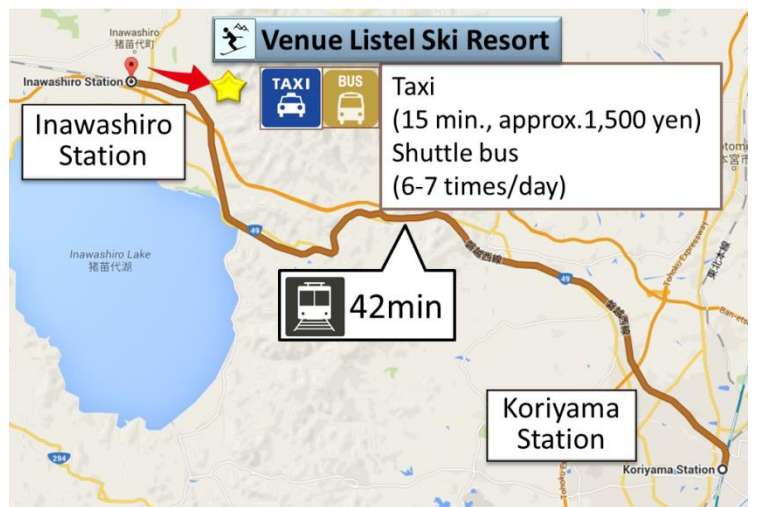
Yoichiro Ikeda

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Note: The certificate of attendance will send by email (PDF) within a week after the congress

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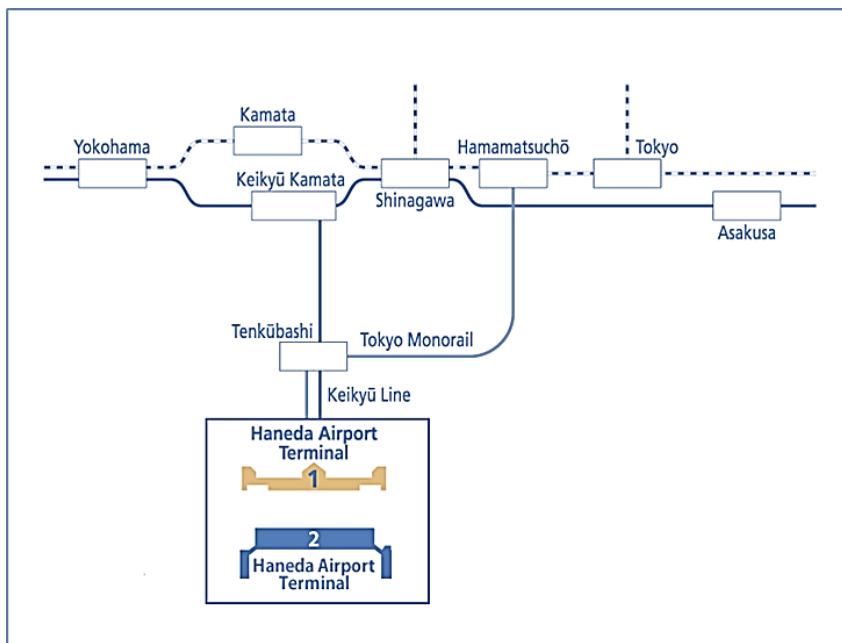
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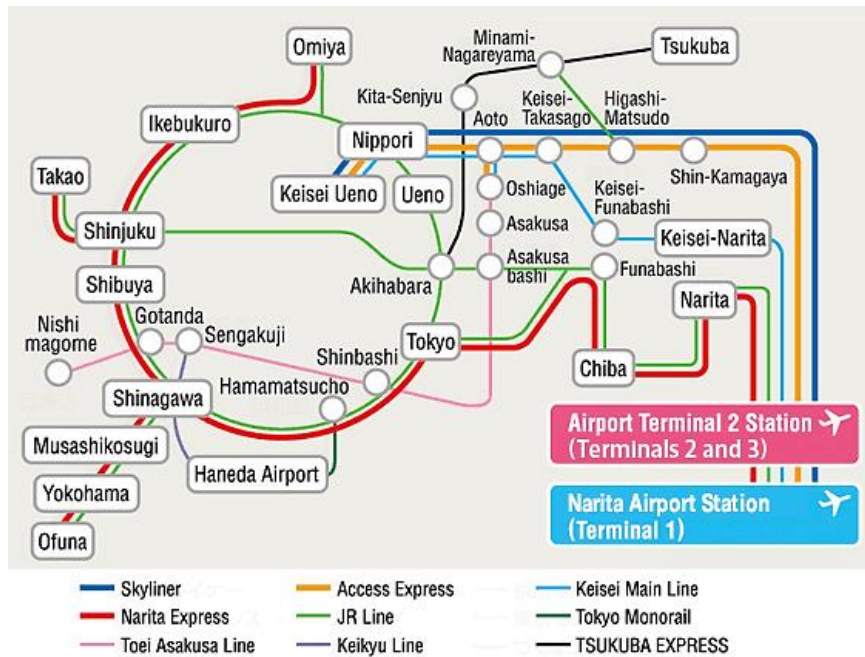
https://www.tokyo-airport-bldg.co.jp/en/access/train/entrance_gate.html

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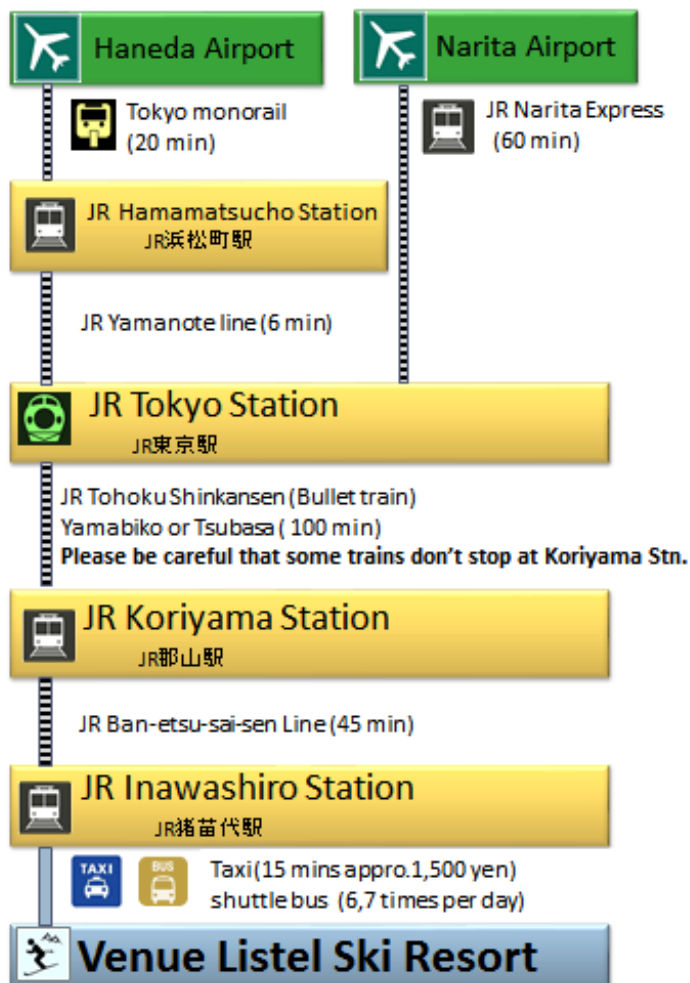
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共同開発者
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