INJURIES AMONG FIGURE SKATERS

THESIS

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THESIS APPROVAL

Graduate Athletic Training Education

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INTRODUCTION

Sustaining an injury is one of the important events for athletes, because injury can force a change in the athlete's career. In the past many athletes have been forced to quit their sports due to severe injuries. Other athletes have not been able to return to the same level as before the injury. Chronic injuries also bother athletes' performances over long periods of time. Injury research has been shown to help prevent injuries in some sports. Major sports such as baseball, football, basketball, soccer, and ice hockey have been studied many times, with the results guiding injury prevention efforts. However, few studies on injuries in figure skating have been conducted. Information from injury research would help to prevent some injuries.

Figure skating is a unique sport in part due to the fact that it takes place on ice. Figure skaters also can compete in several categories and at different performance levels and each may have specific injury risks. Competitive figure skating can be separated into four categories: singles (male and female), pairs, ice dancing, and synchronized skating. It is a unique sport because it contains both artistic and sport components.[1,2] Without both

balanced physical abilities and artistic capability, figure skaters will not be sucessful.[1]

Like other athletes, figure skaters push their bodies to the limits of performance. Therefore, many figure skaters have had experiences of acute or chronic injuries in their career. According to Dubravcic-Simunjark et al,[1] the three most common injuries in figure skaters were foot/ankle injuries, knee injuries, and low back pain. The authors found that both genders reported chronic injuries more than acute injuries. Most of the chronic injuries occurred in the lower extremity. On the other hand, acute injuries were reported in both the upper and lower extremity in figure skating.

Many figure skaters have experienced foot/ankle injuries, because of the stress placed upon this region of the body and their skate boots. Bursitis is one of the common injuries in figure skaters. The most common location of bursitis is medial malleolar and posterior superior calcaneus in figure skaters.[2,3] Stress fractures are not a rare injury in figure skating. According to the article written by Bradley,[3] the most common sites of a stress fracture are as follows: the first and second metatarsals, the fourth and fifth metatarsals, and most commonly in the tarsal navicular. Many cases of the stress fractures are

related to the stress of the leg taking off from the inner edge of the skate.[3,4]

Achilles tendinitis is caused by the limitation of ankle range of motion, especially dorsiflexion and planterflexion.[3] Another mechanism of injury is overuse, because figure skaters usually spend a lot of time for jumping skills during their practice.

Fortin and Roberts[5] found that knee injuries were the second highest type of injury reported in figure skating. Knee injuries in figure skaters are usually an overuse type of injury involving the knee extensor mechanism.[6] Acute injuries such as anterior cruciate ligament tears or meniscal injuries are rare.[7] According to Dubravcic-Simunjak et al,[1] only 2.1% of the subjects reported knee ligament sprains. About 15% of both genders reported jumper’s knee and Osgood-Schlatter disease. Osgood-schlatter’s is common during the early teenage years. The symptoms are pain or discomfort during activities and swelling at the tibial tubercle.[8] The pain is related to the frequency and volume of activities. Stanitki[8] found that the condition is commonly unilateral but 20-30% of athletes report bilateral injuries.

According to Dubravcic-Simunjark et al,[1] low back pain is the third most common injury in their study. Figure

skating requires many hyperextension motions for many elements such as a layback spin and jumping skills. Some athletes reported spondylolysis and spondylolisthesis.[6] Spondylolysis is the stress fracture of lumbar vertebrae and the common site is lumbar spine at L5 bilaterally.[9] The mechanism of injury is lumbar hyperextension and lumbar rotation.[9,10]

This study will attempt to answer the following questions: 1) Is foot/ankle injury prevalence dependent upon figure skating level (basic/intermediate/advanced)? 2) Is knee injury prevalence dependent upon figure skating level (basic/intermediate/advanced)? 3) Is low back pain prevalence dependent upon figure skating level (basic/intermediate/advanced)? This study will also assess what specific structures are involved in injury in the selected regions.

METHODS

This section included the following subsections: research design, subjects, preliminary research, instrumentation, procedures, hypotheses, and data analysis.

Research Design

A descriptive design was used for this study. The independent variables were figure skating level as determined by U.S. Figure Skating and if athletic trainers were available. The dependent variables were the presence of foot/ankle injury, knee injury, and/or low back pain.

The strength of this study was a national conducted survey. A limitation of this study was that only figure skaters over 18 years old were surveyed.

Subjects

The number of subjects were N = 73. Subjects were figure skaters over 18 years of age. The survey was distributed with a cover letter via email and included a direct link of the survey. The published U.S. Figure

Skating contact lists were used. Informed consent was implied with completion and return of the survey.

Preliminary Research

Prior to distribution of the survey, three experts from California University of Pennsylvania were given the Panel of Experts Letter (Appendix C1) and the survey to review. This panel reviewed the survey and provided minimal suggestions for improvements.

Instrumentation

The Injuries in Figure Skaters Survey (Appendix C2) was used in this study. This survey was developed by the researcher for the purpose of determining common injuries such as foot/ankle injuries, knee injuries, and low back pain injuries in figure skaters. Figure skaters were also asked their injury history, their figure skating level as determined by U.S. figure skating, and whether an athletic trainer was available for practices and events.

Procedures

An application was given to the California University of Pennsylvania's Institutional Review Board for Protection of Human Subjects (Appendix C3). After approval, the survey and a cover letter (Appendix C4) were distributed by the researcher. The U.S. Figure Skating contact lists were used to send the survey to figure skaters over 18 years of age. The survey's direct link was included in the cover letter.

Hypothesis Testing

The following hypotheses were based on a review of the literature and the intuition of the researcher.

1. A foot/ankle injury (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).
2. A knee injury (Yes/No) prevalence is dependent upon figure skating level (basic/intermediate/advanced).
3. Low back pain (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).

Data Analysis

The level of significance was set at .05 to test the acceptability of the stated hypotheses. US figure Skating determined 10 skills levels. The 10 levels were skills levels not age groups. The levels were divided into three categories such as basic, intermediate, and advanced by the researcher. The basic group was Snowplow Sam/Basic skills 1-8, the category's figure skaters were not allowed to compete in any regional competitions. The intermediate group was non-test, pre-preliminary, and preliminary free skate. The advanced group was pre-juvenile/open pre-juvenile, juvenile/open juvenile, intermediate, novice, junior, and senior free skate. They were allowed to compete in national or international competitions if figure skaters are permitted to participate.

1. A chi-square test of independence contingency table (2 x 3) was performed to determine if foot/ankle (Yes/No) was dependent upon figure skating level (basic/intermediate/advanced).
2. A chi-square test of independence contingency table (2 x 3) was performed to determine if a knee injury

(Yes/No) was dependent upon figure skating level (basic/intermediate/advanced).

3. A chi-square test of independence contingency table (2 x 3) was performed to determine if a low back pain (Yes/No) was dependent upon figure skating level (basic/intermediate/advanced).

RESULTS

Demographic Data

The total number of the subjects was 73. Within the sample 84% were female (n = 63) and 13.75% represented male (n = 10). Table 1 depicts the characteristics of the participants from the study.

Table 1. Characteristics of Participants

Characteristic	**Range**	**Mean ± SD**
Age	18-71	38.21 ± 15.67
Years of skating	1-64	18.46 ± 14.00
Years of Single	1-64	18.46 ± 14.00
Years of Pair	1-35	2.24 ± 6.81
Years of Ice dance	1-40	9.55 ± 11.79
Years of Synchronized	1-25	4.95 ± 6.22

Table 2 reported the gender result.

Table 2. Gender

Gender	**Frequency**	**Percent**
Male	10	13.75%
Female	63	84.0%

Table 3 represented the participant’s figure skating level.

Table 3. Participants' Figure Skating Level

Figure Skating Level	Frequency	Percent
No-test Free Skate	6	8.0%
Pre-Preliminary	5	6.7%
Preliminary	10	13.3%
Pre-juvenile	6	8.0%
Juvenile	10	13.3%
Intermediate	7	9.3%
Novice	3	4.0%
Junior	6	8.0%
Senior	18	24.0%

Table 4 showed the participants' level.

Table 4. Participants' Level

Participants' Level	Frequency	Percent
Intermediate	21	28.0%
Advanced	50	66.7%
No answer	4	5.3%

Table 5 represented Athletic Trainer availability during competitions.

Table 5. Athletic Trainer Availability during Competition

Availability	Frequency	Percent
Yes	13	17.3%
No	34	45.3%
Not compete	23	30.7%

Table 6 showed Athletic Trainer availability during practices.

Table 6. Athletic Trainer Availability during Practice

Availability	Frequency	Percent
Yes	18	24.0%
No	52	74.3%

Table 7 represented the participants' injury data.

Table 7. Injury Data

Injury	Frequency	Percent
Yes	60	80.0%
No	10	13.3%
No answer	5	6.7%

Table 8 represented the participants' surgery data.

Table 8. Surgery Data

Surgery	Frequency	Percent
Yes	22	29.3%
No	33	44.0%

Table 9 showed the practice days missed by the participants after surgery. The upper range of 1,825 days was 152 months.

Table 9. Practice Days Missed After Surgery

Missing practice	Range	Mean ± SD
Days	5-1825	204.7 ± 389.2

Most of the subjects reported multiple body parts were injured. Table 10 represented the participants' total responses of injured body parts.

Table 10. Total Responses of Injured Body Parts

Body Parts	Frequency	Percent
Ankle	31	18.3%
Knee	30	17.6%
Wrist	20	11.8%
Low back	19	11.2%
Shoulder	12	7.1%
Head	11	6.5%
Foot	10	5.9%
Hip	10	5.9%
Groin	8	4.7%
Elbow	4	2.3%
Thigh	3	1.8%
Face	3	1.8%
Upper back	2	1.2%
Neck	2	1.2%
Finger	2	1.2%
Thumb	1	0.6%
Ear	1	0.6%
Eye	0	0.0%
Nose	0	0.0%

Table 11 represented the participants' injury percentage of lower extremity and upper extremity.

Table 11. Injury Percentage

Body part	Frequency	Percent
Lower Extremity	111	65.7%
Upper Extremity	58	34.3%

Most of the subjects reported multiple types of injuries. Table 12 represented the participants' total responses for name of injury.

Table 12. Total Responses for Name of Injury

Name of injury	Frequency	Percent
Fracture	22	12.9%
Sprain	21	12.3%
Contusion	14	8.2%
Tendinitis	12	7.0%
Concussion	11	6.4%
Strain	10	5.8%
Dislocation	9	5.3%
Cartilage injury	8	4.7%
Laceration	8	4.7%
Undiagnosed low back pain	7	4.1%
Bursitis	5	2.9%
Spondylolithesis	4	2.3%
Stress Fracture	4	2.3%
Subluxation	3	1.8%
Shin splint	3	1.8%
Planter faciitis	2	1.2%
Patellafemoral pain	2	1.2%
Impingement	1	0.6%
Osgood-Schlatter	1	0.6%
Arthritis change	1	0.6%
Bone Spur	1	0.6%
Tenosynovitis	0	0.0%
Spondylolisis	0	0.0%
Compartment Syndrome	0	0.0%
Others	22	12.9%

Table 13 represented the participants’ total responses for which month the injuries occurred.

Table 13. Month of Injury

Month	Frequency	Percent
February	20	12.6%
January	18	11.3%
April	16	10.6%
March	15	9.4%
June	13	8.2%
October	13	8.2%
December	13	8.2%
July	12	7.5%
November	12	7.5%
September	11	6.9%
August	9	5.7%
May	7	4.4%

Table 14 represented the medical professionals that the participants' with surgery selected for post-operational rehabilitation sessions.

Table 14. Rehabilitation with Medical Professional

Medical Professional	Frequency	Percent
Physical Therapist	32	68.1%
Athletic Trainer	8	17.0%
Occupational Therapist	2	4.3%
Chiropractor	3	6.4%
Others	2	4.3%

Hypothesis Testing

All hypotheses were tested at an alpha level of .05.

Hypothesis 1: A chi-square test of independence contingency table (2 x 2) was performed to determine if a foot/ankle injury (Yes/No) was dependent upon figure skating level (intermediate/advanced). A significant interaction was found ($X^2_1 = 5.72$, $P < 0.05$).

Conclusion: Foot/ankle injuries were dependent upon figure skating level (Table 15). The advanced skaters experienced more foot/ankle injuries.

Table 15. 2x2 Chi-Square Independence Test for Foot/Ankle and Figure Skating Level

Skating Level	**Yes**	**No**	***X²***	***P***
Intermediate	3	18	5.72	.017
Advanced	22	28		

Hypothesis 2: A chi-square test of independence contingency table (2 x 2) was performed to determine if a knee injury (Yes/No) was dependent upon figure skating level (intermediate/advanced). No significant interaction was found ($X^2_2 = 0.11$, $P > 0.05$).

Conclusion: A knee injury was independent from figure skating level (Table 16).

Table 16. 2x2 Chi-Square Independence Test for Knee and Figure Skating Level

Skating Level	**Yes**	**No**	X^2	*P*
Intermediate	8	13	0.11	.742
Advanced	17	33		

Hypothesis 3: A chi-square test of independence contingency table (2 x 2) was performed to determine if low back pain(Yes/No) was dependent upon figure skating level (intermediate/advanced). No significant interaction was found ($X^2_3 = 1.16$, $P > 0.05$).

Conclusion: Low back pain was independent from figure skating level (Table 17).

Table 17. 2x2 Chi-Square Independence Test for Low Back Pain and Figure Skating Level

Skating Level	**Yes**	**No**	X^2	*P*
Intermediate	3	18	1.16	.281
Advanced	13	37		

Additional Findings

In addition to hypotheses testing, a chi-square test of independence was performed comparing the frequency of rehabilitation (Yes/No) for the participants' having surgery (Yes/No). A significant interaction was found ($X^2_1 = 6.21$, $P < 0.05$).

Conclusion: Rehabilitation was dependent on surgery (Table 18). Skaters who had surgery were more likely to have rehabilitation.

Table 18. 2x2 Chi-Square Independence Test Comparing Rehabilitation with Surgery

Rehabilitation	**Yes**	**No**	X^2	*P*
Yes	18	4	6.24	.013
No	16	17		

Another additional finding, a chi-square test of independence was performed comparing the frequency of lower extremity injury (Yes/No) with figure skating level (intermediate/advanced). A significant interaction was found ($X^2_1 = 8.23$, $P < 0.01$).

Conclusion: lower extremity injuries were dependent upon figure skating level (Table 19). Advanced figure skaters were more likely to have lower extremity injuries.

Table 19. 2x2 Chi-Square Independence Test for Lower Extremity Injury and Figure Skating Level

Lower Extremity Injury	**Yes**	**No**	X^2	*P*
Intermediate	7	14	8.23	.004
Advanced	35	15		

DISCUSSION

The following will include 1) Discussion of this study's results, 2) Conclusion, and 3) Recommendations from this study.

Discussion of Results

This study focused on the type of injuries that occurred in figure skaters over 18 years of age and also how many participants have athletic trainers available during their practices and competitions. One of the previous studies showed that 79.5% of figure skaters reported injuries during their career.[1] Most of the injuries are chronic type of injuries in figure skating; however, many athletic trainers are not working with figure skaters. No previous research was found that indicated athletic trainers worked with figure skaters in the past.

None of the participants were Snowplow Sam/Basic Skills 1-8; as a result, this study did not use basic as a category. There were 28% of the subjects that were in the category of intermediate and 66.7% of the other skaters were advanced level.

It was found that only 24% of figure skaters had an athletic trainer during their practice and 17.3% had an athletic trainer during their competition regularly. This finding was interesting because there are many athletic trainers in the United States for other sports; however few of them are for figure skating. When comparing football and figure skating, football has more injuries than figure skating; however, figure skating is also high-risk injury sport.

This study also found that 80% of participants reported injury experiences during their figure skating career. The percentage of injury rate was not low at all. There were 29.3% of the skaters reporting that they had surgery for their injury.

Having a foot/ankle injury was found to be dependent upon figure skating level (basic/intermediate/advanced). Advanced level athletes were more likely to have foot/ankle injuries than intermediate level figure skaters. There were 22 advanced participants reporting a foot/ankle injury; however, only 3 intermediate participants reported a foot/ankle injury. Other hypotheses such as knee and low back pain were independent from figure skating level.

The total responses of injured body parts were similar to the previous studies.[1,2,6] This study found that

foot/ankle was the most inured part accounting for 41 of 169 or 24.2% and the second highest injured part was knee accounting for 30 of 169(17.6%). An interesting finding was the third part. Previous studies showed low back was the third highest, but this study found low back was the fourth highest accounting for 19 of 169 or 11.2%.[1,2] The third highest part was wrist with 20 of 169 (11.8%)in this study. The third and fourth did not have a huge difference but it was surprising find. There were 65.7% of injuries that occurred in the lower extremity and upper extremity injuries were 34.3%. One of the additional findings was that advanced figure skaters were more likely to have a lower extremity injury.

This study found that many figure skaters reported acute type of injuries such as fracture (12.9%), sprain (12.3%), contusion (8.2%), concussion (6.4%), strain (5.8%), and dislocation (5.3%) more than chronic types of injury. Some previous studies found that stress fractures in young figure skaters was a higher rate; [1,2,5] however, the participants who were adult skaters reported stress fracture only 2.3% of the time. The participants were over the age of 18 and only one figure skater reported Osgood-Schlatter’s disease in this study.

The researcher asked which month the injury occurred in the survey. Most of the injuries occurred in February (12.6%), January (11.3%), followed by March (10.6%). During the competition season, many figure skaters had experiences of injuries. Figure skaters were possibly to have so much pressure on them physically and mentally during the season; as a result, the injury rate was increased. The second peak was June (8.2%) and July (7.5%). During the peak, many athletes conjecturally participated in summer camps; as a result, their injury level was increased due to the second peak of activity.

Rehabilitation is important for injured athletes to return to play and recover from injury for all injured athletes. The participants answered which medical professional provided their rehabilitation. The majority of skaters were working with physical therapists (68.1%). Only 17% of figure skaters worked with athletic trainers for their rehabilitation. This study found that rehabilitation was dependent upon surgery. It was surprising that four figure skaters answered they had surgery but they did not participate in any rehabilitation sessions. For the subjects who did not have surgery; 16 skaters had rehabilitation sessions and 17 did not have any rehabilitation sessions.

Conclusions

After reviewing the results of this study, it is concluded that most of the figure skaters had experienced some injuries during their career. Surprisingly, a higher percentage of the participants regularly had access to athletic trainers during practice than competition. Athletic trainers who work with figure skaters could be hired for ice hockey as well. That may be a reason why more athletic trainers worked with skaters during practices than competitions. Understanding of the type of injuries and common body parts injured in figure skating may help to prevent injuries. Figure skaters should work on strengthening the body parts where most injuries occurred for injury prevention during the off season. Most of the figure skaters who had rehabilitation worked with physical therapists more than an athletic trainer. The figure skaters who were over the age of 18 reported acute injuries more than chronic injuries in this study.

Recommendations

There are some recommendations that can be made as a result of this study for future research. First, the survey

would need to include all category levels as determined by the U.S. Figure Skating Organization. Adult figure and young figure skaters have different figure skating levels. It would also be beneficial to research both young skaters under 18 years of age and adult skaters over 18 years of age. Another suggestion would be to list more injury names in the survey because many figure skaters answered the response “others” which did not specify any injury name.

REFERENCES

1. Dubravicic-Simunjak S, Pecina M, Kuipers H, Moran J, Haspl M. The incidence of injuries in elite junior figure skaters. *American J Med*. 2003;31:511-517.

2. Jaworski CA, Ballantine-Talmadge S. On thin ice: preparing and caring for the ice skater during competition. *Curr Sports Med Rep*. 2008;7:133-137.

3. Bradley MA. Prevention and treatment of foot and ankle injuries in figure skating. *Curr Sports Med Rep*. 2006;7:258-261.

4. Pecina M, Bojanic I, Dubravcic S. Stress fracture in figure skaters. *American J Sports Med*. 1990;18:277-279.

5. Fortin JD, Roberts D. Competitive figure skating injuries. *Pain Physician*. 2003;6:313-318.

6. Bloch RM. Figure skating injuries. *Physical Med Rehab Clinics N America.* 1999;10:177-188.

7. Lipetz J, Kruse RJ. Injuries and special concerns of female figure skaters. *Clinics Sports Med*. 2000;19:369-380.

8. Stanitki CL. Knee overuse disorders in the pediatric and adolescent athlete. *Institutional Course Lectures*. 1993;42:482-495.

9. Iwamoto J, Takeda T, Wakamoto K. Returning athletes with severe low back pain and spondylolysis to original sporting activities with conservative treatment. *Scand J Med Sci Sports*. 2004;14:346-351.

10. Omey ML, Micheli LJ, Gerbino PG. Idiopathic scoliosis and spondylolysis in the female athlete. *Clinical Ortho Related Research*. 2000;372:74-84.

APPENDICES

APPENDIX A

Review of the Literature

REVIEW OF LITERATURE

Figure skating is a unique sport in part, due to the fact that it takes place on ice. Like other athletes, figure skaters push their bodies to the limited of performance. Therefore, many figure skaters have had experiences of acute or chronic injuries in their career. According to Dubravcic-Simunjark et al,[1] their study showed that the three most common injuries in figure skaters were foot/ankle injuries, knee injuries, and low back pain. Other than this study, there has been little figure skating related injury research done in the past.

Figure skaters can compete in several categories and at different performance levels and each may have specific injury risks. Competitive figure skating can be separated into four categories: singles (male and female), pairs, ice dancing, and synchronized skating. It is a unique sport because it contains both artistic and sport components.[1,2] Without both balanced physical abilities and artistic capability, figure skaters will not be sucessful.[1]

The purpose of this review of literature is to understand the forces places on the body by figure skating and the common injuries that may result. This literature review will focus on the three most common injuries in

figure skaters as identified by Dubravcic-Simunjark et al:[1] 1) foot/ankle injuries, 2) knee injuries, and 3) low back pain. The foot/ankle injuries section will include 1) Bursitis, 2) Stress fracture, and 3) Achilles tendinitis/tenosynovitis. A summary will also be included.

One of the study was done by Dubravcic-Simunjark et al,[1] they corrected surveys from junior elite figure skaters. The subjects were 572 junior figure skaters and 469 figure skaters answered questionnaires. Female figure skaters were 236 and 233 male figure skaters. The female and male figure skaters mean ages were 16 years old and 18 years old respectively.[1]

According to Dubravcic-Simunjark et al,[1] female figure skaters reported that acute injuries were 59 skaters and chronic injuries were 101 figure skaters. 19 figure skaters reported low back pain. Various parts of Stress fractures were reported from 29 females. Male figure skaters reported 65 acute injuries, 106 chronic injuries, and 23 low back pain.[1]

The authors found that both gender reported chronic injuries more than acute injuries.[1] Most of the chronic injuries were occurred in lower extremity, only one injury was reported for lumbar spine. One the other hand, acute injuries were reported both upper and lower extremity in

figure skating. Only pair skaters reported shoulder injuries and more percentage of acute injuries than other skaters.[1] Their study showed that the three most common injuries in figure skaters were foot/ankle injuries, knee injuries, and low back pain.

Foot/Ankle Injuries

Many figure skaters have experienced foot/ankle injuries, because of the stress placed upon this region of the body and their skate boots. The boots are composed of two parts. The boot part is made by four hard layers of leather and another part is the blade which is made of steel.[1,2] Skaters need a hard support around their ankle due to the support needed for the high level of skills and required by their sports. The boots also need to prevent sprains and other ankle problems. On the other hand, the figure skating boot tends to cause foot and ankle injuries as well.[3] According to Dubravcic-Simunjak,[1] the lower extremity injury rate was increased by age. Sixty percent of figure skaters between 8 and 14 years old reported lower extremity injuries; however, 70% of figure skaters between 15 and 20 years old reported lower extremity injuries. Other athletes wear shoes of designed to provide support.

Gamboa et al,[4] collected injury data from elite preprofessional ballet dancers. Ballet dancers wear point shoes which contain a hard wood toe part; as a result, 53.4% of the ballet dancers reported foot/ankle injuries.[4]

Bursitis

Bursitis is one of the common injuries in figure skaters. The function of bursa is cushioning the soft tissue of the ankle from friction force.[5] The most common location of bursitis is medial malleolar and posterior superior calcaneus in figure skaters.[2,3] In figure skaters, bursitis is typically aseptic bursitis from either acute or chronic mechanisms.[5] The mechanism of injury for bursitis is inappropriate fitting of figure skating boots. The wrong fitting tends to result in abnormal pressure and shear forces. When figure skaters buy a new pair of boots, they are increasing the chance to have bursitis.[5]

A skater can prevent bursitis by rechecking their figure skating boots. Figure skaters can add extra padding or use a ball-and-ring to extend the leather in the skate to make more room for the irritated area.[5]

Stress Fracture

Stress fractures are not a rare injury in figure skating. According to the article written by Bradley,[3] the most common sites of a stress fracture are as follows: the first and second metatarsals, the fourth and fifth metatarsals, and most commonly in the tarsal navicular. A study done during the preseason by Pecina, Bojanic, and Dubravcic,[6] identified stress fractures in four cases, and five stress fractures occurred during the season. Two athletes had a Jones' fracture, two of the athletes had tarsal navicular stress fracture, and an athlete fractured the middle of the third metatarsal.

The mechanism of injury is a result of figure skaters changing their training routine, increasing running distance, and increasing training time that required jumping on the ice. Many cases of the stress fractures are related to the leg taking off from the inner edge of the skate.[3,6]

Achilles Tendinitis/Tenosynovitis

Figure skating boots are hard due to the need to support the athlete's foot. The support system is important for them; however, it limits ankle range of motion, especially dorsiflexion and planterflexion.[3] The limitation

is one of the causes of Achilles tendinitis. Another mechanism of injury is overuse, because figure skaters usually spend a lot of time for jumping skills during their practice. Figure skaters need to absorb stress from landing of jumps successfully; otherwise, achilles tendinitis is possible.[2,3] Another achilles tendon related injury is tenosynovitis. It occurs by presenting friction forces between the figure skating boot and the tendon when they flex their ankles and knees.[3]

Knee Injuries

Jumping exercises can produce a lot of force especially when figure skater's land on a leg, because the landing is always on the same leg. The knee on the landing leg has to absorb great force due to the limitation of the ankle range of motion.[3] Many figure skaters injure the dominant side of the lower extremity, because this side usually is used for landing from jumping exercises.[7]

Fortin and Roberts[7] found that knee injuries were the second highest type of injury reported in figure skating. Knee injuries in figure skaters are usually an overuse type of injury by a knee extensor mechanism.[8] Acute injuries such as anterior cruciate ligament tears or meniscal injuries

are rare.[9] According to Dubravcic-Simunjak et al,[1] only 2.1% of the subjects reported knee ligament sprains.

One of the overuse types of injuries is Sinding-Larsen-Johansson disease. The condition is common in 10 to 12 year olds. The injury occurs at the inferior pole of the patella and related in anterior knee pain.[10] The mechanism of injury is substantive traction force presenting at the patellar tendon.[8] As a result, the inferior patellar pole would have calcification and ossification.[10] The injury requires about 12 to 18 months to heal. The patients often need to be limited their sports participation levels.[10]

According to Dubravcic-Simunjak et al,[1] about 15% of both genders reported jumper’s knee and Osgood-Schlatter disease. Smith et al,[11] examined the relationship between flexibility and anterior knee pain in adolescent elite figure skaters. The authors predicted flexibility and anterior knee pain were correlated. The subjects were 46 adolescent elite figure skaters with anterior knee pain. Fourteen athletes reported anterior knee pain which included the jumper’s knee, Osgood-Schlatter disease, and isolated patello femoral pain syndrome.[11] Some athletes associated different injuries with patello femoral pain syndrome. Both female and male junior figure skaters had an

experience of either the jumper's knee or Osgood-Schlatter disease. There is no gender difference.[1]

Osgood-schlatter's is common during the early teenage years. The symptoms are pain or discomfort during activities and swelling at the tibial tubercle.[10] The pain is related to the frequency and volume of activities. According to Stanitki,[10] the condition is common unilaterally but 20-30% of athletes report bilateral injuries. Athletes who participate in jumping, squatting or kneeling could experience Osgood-Schlatter's disease. The mechanism of injury is repetitive tensile forces on the immature patellar tendon.[10] The prevention of the injury is increasing flexibility especially in the hamstring and quadriceps. Controlling sports activities is necessary when athletes have symptoms.[10]

According to Dixit et al,[12] the definition of patello femoral pain is anterior knee pain related to the patella and retinaculum. One of the causes of patello femoral pain syndrome is a weak vastus medialis oblique muscle, because many figure skaters' vastus lateralis is well developed as compared to the medialis.[9] Another reason that Patello femoral pain is involved is incorrect patellar tracking. Most athletes feel the pain behind or around the patella. When they perform activities such as running or activities

involving knee flexion, the pain is increased.[12] Body posture is related to the pathology as well. The athlete who has pes planus, abnormal Q angle, or subtalar pronation could have a greater chance of patello femoral pain syndrome.[12]

Smith, Stroud and McQueen[11] found that figure skaters of both genders did not have good flexibility of either quadriceps or hamstrings. Both female and male figure skaters with inflexible quadriceps had anterior knee pain at a high rate.[11] Only female figure skaters with hamstring tightness had patello femoral pain. On the other hand, male figure skaters with tight hamstrings did not show a relationship between flexibility and anterior knee pain.[11] Smith et al,[6] concluded that flexibility and anterior knee pain were related but vary between genders.

Low Back Pain

According to Dubravcic-Simunjark et al,[1] low back pain is the third most common injury in their study. One of the studies written by Gamboa et al,[4] found that low back pain in elite preprofessional dancers is the fourth ranked injury. This study also compared injured athletes to non-

injured athletes, 56% of the injured dancers reported history of low back pain.[4]

Figure skating requires many hyperextension motions for many elements such as layback spin and jumping skills. Some athletes reported spondylolysis and spondylolisthesis.[8] These injuries are common in figure skating and other sports as well. According to Gamboa et al,[4] 9.4% of the elite preprofessional ballet dancers reported low back pain. Many dancers with low back pain were determined to have limited range of motion of hip adduction. The limitation causes lateral hip and knee pain in the dancers.[4] Spondylolysis is the stress fracture of lumbar vertebrae and the common site is lumbar spine at L5 bilaterally.[13] The mechanism of injury is lumbar hyperextension and lumbar rotation.[13,14] Iwamoto and Wakano[10] found that the most common subjects' age for this condition is between 15-19 years old, because their bones are still immature. Omey, Micheli and Gerbino,[14] reported that athletes with lasting low back pain needs to be vigilant, because they have a higher risk of spondylolysis. Forty seven percent of spondylolisis patients are adolescent and adult athletes.[14] Generally, 6% of the population could have spondylolisis and half of low back pain is caused by the pathology.[15] Athletes with the injury usually complain of pain with hyperextension and

show hamstring tightness, hyperlordotic posture, and limited range of motion.[14,15]

Spondylolisthesis is where one vertebrae slip or when the vertebrae moves forward over another.[15] The most common site of spondylolisthesis is between L5-S1 region, and female athletes could have a higher grade spondylolisthesis than male athletes.[16] Some athletes with spondylolisthesis reposted chronic low back pain. The mechanism of injury is overuse, degeneration, or a history of spondylolysis.[15] General treatment of spondylolysis and spondylolisthesis is non-surgical treatment. According to Tallarico et al,[16] rest is the primal treatment of these conditions. However, some athletes with spondylolisthesis need surgical treatment, if the athletes failed non-surgical treatment after six months of period.

One of the studies done by Silfies et al,[17] examined lumber position and low back injuries in college athletes. The authors made a hypothesis that athletes with a history of low back pain would have poor lumber position. The authors examined passive and active trunk reposition and motion perception threshold.[17] In the conclusion, the authors could not prove the hypothesis, because the injured athletes and non-injured athletes did not show any significant differences.[17]

According to Fortin and Roberts,[7] some athletes reported sacroilical joint dysfunction, because of their landings and missed landings. Both complete and imcomplete landings affect their sarcroiliac joint due to torsion stress. Figure skaters always land on the same leg; as a result, the gluteus muscle groups are not balanced well.[7] Most figure skaters use their landing on the right side, some figure skaters have a functional short leg on the right side as well.[7]

Summary

Figure skating is a unique sport in part, because the sport occurs on ice. Many figure skaters have had either acute or chronic injury experiences in their skating career. Dubravacic-Simunjak et al,[1] performed a study examining common injuries in figure skating. The authors found that foot/ankle injuries, knee injuries, and low back pain are the three commonly injured areas of the body.[1]

Foot/ankle injuries are the most common injuries in figure skaters in part because of figure skating boots.[1] There are three common injuries in foot/ankle injuries such as bursitis, stress fracture, and Achilles tendinitis/tenosynovitis.

The second common injury is knee injuries. It is usually an overuse type of injury.[8] Sinding-Larsen-Johansson disease is one of the overuse type of injuries. The mechanism of injury is repeating traction force at the inferior patella tendon.[10] According to Smith et al,[11] there is a relationship between anterior knee pain and flexibility. Osgood-Schlatter's disease is also an overused injury. The cause of this injury is repetitive tensile forces.[10] Some figure skaters experience patella femoral pain. The pain causes muscle imbalance especially vastu medialis oblique muscle weakness.[9]

The third common injury in figure skating is low back pain. Figure skaters need to perform hyperextension movements in their practice, this causes the low back pain. Spondylolisis and spondylolisthesis are reported from some figure skaters. Spondylolisys is the stress fracture of lumbar spine and spondylolisthesis is the forward slipping of the vertebrae. Both conditions occur around the L5 area. Silfies et al,[17] found that previous history of low back pain and lumber position are influenced.

APPENDIX B

THE PROBLEM

THE PROBLEM

Statement of the Problem

Most figure skaters have had acute or chronic injuries in their career, similar to other athletes. Injury is not good for athletes because it sometimes can decrease their abilities or limit their participation temporarily or permanently. There are many studies on injuries for many sports; however, figure skating has had a little research.

Athletic trainers are working with a variety of sports to help with injury prevention, rehabilitation, and treatment. However, most of the past research has not examined how many figure skaters regularly have an athletic trainer for their practice or competition. The purpose of this study is to determine what types of injuries are common in figure skaters and how many figure skaters have athletic trainers for their practice or competition.

Definition of Terms

The following terms have been defined for the purpose of this study:

1. Figure skating: skating on ice and performing a variety of steps including jumps and spins.[8] It contains both artistic and sport components.[1,2]

2. Ice dancing: skating with both female and male together. They do not perform jumping or overhead lifting. Ice dance program emphasizes movement with the music.[8] Their program includes very difficult step sequences. If the ice dancers perform a step sequence together, they have to skate closely as close as possible.[8]
3. Pair skating: A female and a male are skating together. Male figure skaters throw the partner into a jump or they jump separately at the same time. Pair skaters' program included lifting skills where the female skater is lifted by the partner over the shoulders or lifted horizontal to the ice. They also perform step sequences together or separately.[8]
4. Single skating: skating individually on ice. [8]
5. Synchronized skating: A group skating of team members where there are a minimum 12 skaters and a maximum of 20 skaters. The emphasis is on the union and the pattern made on the ice.[8]

Basic Assumptions

There are several basic assumptions the researcher used during this study.

1. The subjects will respond to the survey honestly and to the best of their ability.
2. The survey will have content validity after review by a panel of experts.
3. There will be a high return rate because of a national survey.

Limitations of the Study

The following are possible limitations of the study:

1. Incorrect names or email addresses of directors of the figure skating clubs could be included in the list serve.
2. Some subjects may not completely recall their past history of injuries.
3. Some subjects may not know medical terminology in the survey.

Delimitations

The following are possible delimitations of this study:

1. The survey will be answered only by figure skaters over the age of 18.
2. Only figure skaters in the United States will be subjects.

3. All subjects will have to have computer access to complete the survey.

Significance of the Study

Many figure skaters have had experiences of either acute or chronic injuries in their career. This study can help those figure skaters, coaches, athletic trainers become aware of common injuries in figure skating. It also can provide some benefit for preventing injuries. Prevention is the very important key for figure skater, because injury can negatively affect their performance. Increasing knowledge of injuries can benefit treatment and rehabilitation as well. The advantages will help athletes to return to play early.

APPENDIX C

ADDITIONAL METHODS

APPENDIX C1

Panel of Experts Letter

Date

Dear Panel of Experts,

My name is Maya Hagiwara and I am a graduate student at California University of Pennsylvania pursing a Master of Science degree in Athletic Training. To fulfill the thesis requirement for this program, I am conducting a descriptive study. The objective of this study is to determine what kinds of injuries are common in figure skaters and how many figure skaters have athletic trainers for their practice and competition. The subjects will be figure skaters over 18 years old. I will be using the Injuries in Figure Skaters survey.

In order to increase the content validity of the instrument, a panel of experts has been chosen to review the survey. You have been selected as one of the three professionals to be on this panel due to your position and experience. Your feedback is very important to the success of this study and to enhance the content validity of the questionnaire. The information obtained by this panel of experts review will be used to make revisions and create the final survey to be distributed to the population sample.

After reading the questionnaire, please respond to the questionnaire by answering four questions on the back of this letter.

I appreciate your time and efforts.

Sincerely,

Maya Hagiwara,
California University of Pennsylvania
Phone #
Email

1. Please comment on question appropriateness, question validity, question understanding, and the overall visual appearance of the questionnaire.

2. Should any additional items be added to the questionnaire?

3. Should any items from the questionnaire be excluded?

4. Please feel free to make any additional comments or criticism on the questionnaire.

APPENDIX C2

Injuries in Figure Skaters Survey

Injuries in Figure Skaters Survey

Please answer the following questions.

1. What is your age? _____

2. What is your gender? Male ☐ Female ☐

3. How many years have you been figure skating?
_____ Years
How many years have you been skating each category below?

Single skating _____
Pair skating _____
Ice dancing _____
Synchronized skating _____

4. What is your level of figure skating?
Snowplow Sam/Basic Skills ☐
No-test Free Skate ☐
Pre-Preliminary Free Skate ☐
Preliminary Free Skate ☐
Pre-juvenile/Open Pre-Juvenile Free Skate ☐
Juvenile/Open Juvenile Free Skate ☐
Intermediate Free Skate ☐
Novice Free Skate ☐
Junior Free Skate ☐
Senior Free Skate ☐

5. Do you have an athletic trainer available during your competitions regularly? Yes ☐ No ☐ I do not compete
Do you have an athletic trainer available during your practices regularly? Yes ☐ No ☐

6. Have you ever had an injury that resulted from your participation in figure skating? Yes ☐ No ☐

If Yes, go to question 7
If No, your survey is done. Thank you for participating in my study.

7. List all injuries you have had in figure skating

Body part	Name of the injury	How many days did you take off from practice?	In what month did the injury occur?
Ex) ankle	sprain	5 days	October
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Body part: (drop down list)

1.Foot	2.Ankle	3.Knee
4.Thigh	5.Groin	6.Hip
7.Low back	8.Upper back	9.Neck
10.Head	11.Shoulder	12.Elbow
13.Wrist	14.Finger	15.Thumb
16.Face	17.Ear	18.Eye
19.Nose		

Name of injuries: (drop down list)

1.Concussion	2.Sprain
3.Strain	4.Contusion
5.Fracture	6.Tendinitis
7.Tenosynovitis	8.Dislocation
9.Subluxation	10.Spondylolisis
11.Spondylolithesis	12.Compartment syndrome
13.Planter faciitis	14.Impingement
15.Bursitis	16.Osgood-Schlatter disease
17.Patellafemoral pain	18.Cartilage injury
19.Arthritis	20.Undiagnosed pain
21.Stress fracture	22.Bone spur
23.Shin splint	24.Laceration
25.Others	

8. Which injury from the above list would you consider the most serious?

_____

a. How long did it take you to return to play for the most serious injury? _____

b. Have you had a surgery for the most serious injury? Yes ☐ No ☐

c. Did you attend rehabilitation sessions for your injury? Yes ☐ No ☐

d. Who performed your rehabilitation?
Athletic trainer ☐ Physical Therapist ☐
Occupational therapist ☐ Chiropractor ☐
Others _____

APPENDIX C3

Institutional Review Board

California University of Pennsylvania

Proposal Number
08-037
Date Received
12/10/08

PROTOCOL for Research Involving Human Subjects

Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects

(Reference IRB Policies and Procedures for clarification)

Project Injuries among Figure Skating

Researcher/Project Director Maya Hagiwara

Phone # 507-469-9589 ***E-mail Address*** hag1482@cup.edu

Faculty Sponsor (if required) Dr. Carol Biddington

Department Health Science and Sports Studies

Project Dates January 2009 ***to*** April 2009

Sponsoring Agent (if applicable) _____

Project to be Conducted at California University of Pennsylvania

Project Purpose: ☒ ***Thesis*** ☐ ***Research*** ☐ ***Class Project*** ☐ ***Other***

Keep a copy of this form for your records.

Required IRB Training

The training requirement can be satisfied by completing the online training session at http://cme.nci.nih.gov/ . *A copy of your certification of training must be attached to this IRB Protocol. If you have completed the training at an earlier date and have already provided documentation to the California University of Pennsylvania Grants Office, please provide the following:*

Previous Project Title _____

Date of Previous IRB Protocol _____

Please attach a typed, detailed summary of your project AND complete items 2 through 6.

1. *Provide an overview of your project-proposal describing what you plan to do and how you will go about doing it. Include any hypothesis(ses)or research questions that might be involved and explain how the information you gather will be analyzed. For a complete list of what should be included in your summary, please refer to Appendix B of the IRB Policies and Procedures Manual*

The survey was reviewed by a panel of three experts from California University of Pennsylvania. The research study will be sent to the California University of Pennsylvania's Institutional Review Board for Protection of Human Subjects. Upon IRB approval, the survey letter with survey link developed by the researchers will be distributed to adult figure skaters over age 18 years old via the US Figure Skating Association. The researcher will allow two weeks for the subjects to complete the survey. After two weeks, potential subjects will be contacted again reminding them to complete the survey if they have not done so already. Surveys will not contain any information that can identify the subject.

The following hypotheses are based on a review of the literature and the intuition of the researcher.

1. Low back pain (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).
2. A knee injury (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).
3. A foot/ankle injury (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).

The level of significance was set at .05 to test the acceptability of the stated hypotheses.

1. A chi-square test of independence contingency table (2 x 3) will be performed to determine if Low back pain (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).
2. A chi-square test of independence contingency table (2 x 3) will be performed to determine if a knee injury (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).
3. A chi-square test of independence contingency table (2 x 3) will be performed to determine if a foot/ankle injury (Yes/No) is dependent upon figure skating level (basic/intermediate/advanced).

2. *Section 46.11 of the Federal Regulations state that research proposals involving human subjects must satisfy certain requirements before the IRB can grant approval. You should describe in detail how the following requirements will be satisfied. Be sure to address each area separately.*

   a. *How will you insure that any risks to subjects are minimized? If there are potential risks, describe what will be done to minimize these risks. If there are risks, describe why the risks to participants are reasonable in relation to the anticipated benefits.*

      No research will be conducted until approval is granted by the IRB. Subject participation is voluntary and anonymous. There are no foreseeable risks involved with completion of the survey questions.

   b. *How will you insure that the selection of subjects is equitable? Take into account your purpose(s). Be sure you address research problems involving vulnerable populations such as children, prisoners, pregnant women, mentally disabled persons, and economically or educationally disadvantaged persons. If this is an in-class project describe how you will minimize the possibility that students will feel coerced.*

The survey will be distributed to adult members of the US figure Skating Association. Skaters will be over 18 years old.

c. *How will you obtain informed consent from each participant or the subject's legally authorized representative and ensure that all consent forms are appropriately documented? Be sure to attach a copy of your consent form to the project summary.*

Informed consent is implied upon completing and returning the survey. Subjects have the right to chose not to participate. This is stated in the cover letter that will be introduce the survey and include the survey link.

d. *Show that the research plan makes provisions to monitor the data collected to insure the safety of all subjects. This includes the privacy of subjects' responses and provisions for maintaining the security and confidentiality of the data.*

This is an anonymous questionnaire and upon submission, neither the name of the subject nor email address will be attached to their answers. The information will be kept strictly confidential and pooled with other subject responses. The data will be kept in a secure location where only the researcher and advisor will have access.

3. *Check the appropriate box(es) that describe the subjects you plan to use.*

☒ *Adult volunteers*	☐ *Mentally Disabled People*
☐ *CAL University Students*	☐ *Economically Disadvantaged People*
☐ *Other Students*	☐ *Educationally Disadvantaged People*
☐ *Prisoners*	☐ *Fetuses or fetal material*
☐ *Pregnant Women*	☐ *Children Under 18*
☐ *Physically Handicapped People*	☐ *Neonates*

4. *Is remuneration involved in your project?* ☐ *Yes or* ☒ *No. If yes, Explain here.*

5. *Is this project part of a grant?* ☐ *Yes or* ☒ *No If yes, provide the following information:*

Title of the Grant Proposal _____

Name of the Funding Agency _____

Dates of the Project Period _____

6. *Does your project involve the debriefing of those who participated?* ☐ *Yes or* ☒ *No*

If Yes, explain the debriefing process here.

If your project involves a questionnaire interview, ensure that it meets the requirements of Appendix __ in the Policies and Procedures Manual.

Project Director's Certification
Program Involving HUMAN SUBJECTS

The proposed investigation involves the use of human subjects and I am submitting the complete application form and project description to the Institutional Review Board for Research Involving Human Subjects.

I understand that Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects. If the Board grants approval of this application, I agree to:

1. Abide by any conditions or changes in the project required by the Board.
2. Report to the Board any change in the research plan that affects the method of using human subjects before such change is instituted.
3. Report to the Board any problems that arise in connection with the use of human subjects.
4. Seek advice of the Board whenever I believe such advice is necessary or would be helpful.
5. Secure the informed, written consent of all human subjects participating in the project.
6. Cooperate with the Board in its effort to provide a continuing review after investigations have been initiated.

I have reviewed the Federal and State regulations concerning the use of human subjects in research and training programs and the guidelines. I agree to abide by the regulations and guidelines aforementioned and will adhere to policies and procedures described in my application. I understand that changes to the research must be approved by the IRB before they are implemented.

Professional Research

Project Director's Signature

Department Chairperson's Signature

Student or Class Research

Maya Hayward
Student Researcher's Signature

Carol Biddy Martin
Supervising Faculty Member's Signature if required

Department Chairperson's Signature

ACTION OF REVIEW BOARD (IRB use only)

The Institutional Review Board for Research Involving Human Subjects has reviewed this application to ascertain whether or not the proposed project:

1. provides adequate safeguards of the rights and welfare of human subjects involved in the investigations;
2. uses appropriate methods to obtain informed, written consent;
3. indicates that the potential benefits of the investigation substantially outweigh the risk involved.
4. provides adequate debriefing of human participants.
5. provides adequate follow-up services to participants who may have incurred physical, mental, or emotional harm.

Stipulation

☒ Approved ☐ Disapproved

Chairperson, Institutional Review Board

01-23-09
Date

Draft, April 7, 2005

APPENDIX C4

Cover Letter

Dear Participant:

I am a master's degree candidate at California University of Pennsylvania, requesting your help to complete part of my degree requirements. Please follow the link at the end of this letter to an online survey titled: Injuries in Figure Skaters.

All figure skaters who are over 18 years of age and are members of the US Figure Skating are being asked to submit this questionnaire, but you have the right to choose not to participate or to discontinue participation at any time. The participants must be over age 18 years old. The California University of Pennsylvania Institutional Review Board has approved this study for the Protection of Human Subjects.

This is an anonymous questionnaire and upon submission, neither your name nor email address will be attached to your answers. Your information will be kept strictly confidential. The questionnaire consists of 8 questions, which will take about 5 to 10 minutes to complete.

As a figure skater over 18 years of age, your injury history and availability of an athletic trainer during practice and/or competition makes your input invaluable. Please take a few minutes to fill out the anonymous questionnaire you will find by clicking on this link:

http://www.surveymonkey.com/s.aspx?sm=HmBL0nLUJbWuhQaJU8NVPw_3d_3d

Thank you for your time and consideration.

Sincerely,

Maya Hagiwara, ATC, PES
California University of Pennsylvania
250 University Ave.
California, PA 15419
hag1482@cup.edu

Carol Biddington, EdD
Faculty Advisor
Health Science and Sport Studies
724-938-4562

REFERENCES

1. Dubravicic-Simunjak S, Pecina M, Kuipers H, Moran J, Haspl M. The incidence of injuries in elite junior figure skaters. *American J Med*. 2003;31:511-517.

2. Jaworski CA, Ballantine-Talmadge S. On thin ice: preparing and caring for the ice skater during competition. *Curr Sports Med Rep*. 2008;7:133-137.

3. Bradley MA. Prevention and treatment of foot and ankle injuries in figure skating. *Curr Sports Med Rep*. 2006;7:258-261.

4. Gamboa JM, Roverts LA, Maring J, Fergus A. Injury patterns in elite preprofessional ballet dancers and the utility of screening programs to identify risk characteristics. *J Ortho Sports Physical Therapy*. 2008;38:126-136.

5. Brown TD, Varney TE, Micheli LJ. Malleolar bursitis in figure skaters: indications for operative and nonoperative treatment. *American J Sports Med*. 2000;28:109-111.

6. Pecina M, Bojanic I, Dubravcic S. Stress fracture in figure skaters. *American J Sports Med*. 1990;18:277-279.

7. Fortin JD, Roberts D. Competitive figure skating injuries. *Pain Physician*. 2003;6:313-318.

8. Bloch RM. Figure skating injuries. *Physical Med Rehab Clinics N America.* 1999;10:177-188.

9. Lipetz J, Kruse RJ. Injuries and special concerns of female figure skaters. *Clinics sports Med*. 2000;19:369-380.

10. Stanitki CL. Knee overuse disorders in the pediatric and adolescent athlete. *Institutional Course Lectures*. 1993;42:482-495.

11. Smith AD, Stroud L, Mcqueen C. Flexibility and anterior knee pain in adolescent elite figure skaters. *J Pediatric Ortho*. 1991;11:77-82.

12. Dixit S, Difiori JP, Burton M, Mines B. Management of patellofemoral pain syndrome. *American Family Physician*. 2007;75:194-202.

13. Iwamoto J, Takeda T, Wakamoto K. Returning athletes with severe low back pain and spondylolysis to original sporting activities with conservative treatment. *Scand J Med Sci Sports*. 2004;14:346-351.

14. Omey ML, Micheli LJ, Gerbino PG. Idiopathic scoliosis and spondylolysis in the female athlete. *Clinical Ortho Related Research*. 2000;372:74-84.

15. Cassas KJ, Cassettari-Wayhs A. Childhood and adolescent sports-related overuse injuries. *American Famnily Physician*. 2006;73:1014-1022.

16. Tallarico RA, Madom IA, Palumbo MA. Spondylolysis and spondylolisthesis in the athlete. *Sports Med Arthrosc Rev*. 2008;16:32-38.

17. Silfies SP, Cholewicki J, Reeves NP, Greene HS. Lumber position sense and the risk of low back pain injuries in college athletes: a prospective cohort study. *BMC Muschiloskeletal Disorders*. 2007;8:129-135.

ABSTRACT

TITLE: INJURIES AMOUNG FIGURE SKATERS

RESEARCHER: Maya Hagiwara, ATC, PES

DATE: May 2009

RESEARCH TYPE: Master Thesis

ADVISOR: Dr. Carol Biddington

PURPOSE: To determine what types of injuries are common in figure skaters and how many figure skaters have an athletic trainer for their practice or competition.

METHODS: Figure skaters (N=73) over the age of 18 were surveyed. The survey consisted of questions regarding figure skating related injuries and the availability of an athletic trainer during practices and competitions.

FINDINGS: Advanced figure skaters were more likely to have lower extremity injuries and foot/ankle injuries. Figure skaters over the age of 18 years reported acute injuries more than chronic injuries.

CONCLUSION: After reviewing the results of this study it is concluded that most of the figure skaters (80%) had experienced some injuries during their career. Surprisingly the participants had an athletic trainer during practice (24%) more than competition (17.3%) regularly. Understanding of most common injuries and body parts will help to prevent further injuries. Also these information can be used for the off-season strength and conditioning for the purpose of prevention.