

KARIN INNERHOFER<sup>1</sup>  
 GABRIEL KRASTL<sup>2</sup>  
 SEBASTIAN KÜHL<sup>1</sup>  
 ELISABETH  
 N. BAUMGARTNER<sup>1</sup>  
 ANDREAS FILIPPI<sup>1</sup>

# Dental Trauma on Ski Slopes

A study during one winter season

Key words: dental trauma, ski, snowboard, mouthguard, protective gear

<sup>1</sup> Department of Oral Surgery,  
Oral Radiology and Oral Medicine  
and Centre of Dental Trauma-  
tology, University of Basel,  
Switzerland

<sup>2</sup> Department of Periodontology,  
Endodontology and Cariology and  
Centre of Dental Traumatology,  
University of Basel, Switzerland

## Correspondence

Prof. Dr. Andreas Filippi  
Department of Oral Surgery,  
Oral Radiology and Oral Medicine  
and Centre of Dental Traumatology,  
University of Basel, Switzerland  
Hebelstrasse 3, 4056 Basel  
Tel. 061 267 26 10  
Fax 061 267 26 07  
E-mail: andreas.filippi@unibas.ch  
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**Summary Objectives:** Skiing and snowboarding are winter sports with risk of dental trauma. The aim of the present study was to investigate the use of protective gear and the occurrence of dental trauma in amateur winter sports on ski slopes.

**Materials and methods:** A total of 500 skiers and snowboarders (345 skiers, 110 snowboarders, and 45 who rode both) were interviewed using a standardized questionnaire during one winter season (from January to April 2008). Sustained injuries and use of protective gear (including mouthguards) were assessed.

**Results:** Of the 500 interviewed, eleven (9 m, 2 f; 2.2%) had sustained dental trauma while

skiing or snowboarding. Frequent riders were most susceptible to dental trauma ( $p < 0.001$ ). 165 (33%) have sustained a skiing or snowboarding accident at least once, males more often than females ( $p = 0.031$ ). Protective gear was used by 337 (67.4%), helmet, back and wrist protectors being worn most often. Snowboarders were generally protected best ( $p < 0.001$ ). All riders who had sustained an accident ( $n = 124$ ; 75.1%) wore protective gear at the time of the interview ( $p = 0.009$ ). Only two of eleven who had sustained dental trauma wear a mouthguard now for winter sports. **Conclusion:** The results show that skiing and snowboarding pose only a small risk for dental trauma.

## Introduction

Sports-related dental trauma in amateur and hobby sports is common. In other studies, a prevalence of up to 32% was found (HÄYRINEN-IMMONEN ET AL. 1990, TULI ET AL. 2005, HUANG ET AL. 2009). Many tooth injuries occur in sports like ice hockey, basketball, handball, inline skating, mountainbiking and squash (LANG ET AL. 2002, PERUNSKI ET AL. 2005, PERSIC ET AL. 2006, FASCIGLIONE ET AL. 2007, MÜLLER ET AL. 2008, BRUNNER ET AL. 2009). In skiing and snowboarding, head injuries are common, especially face and jaw injuries (MALADIÈRE ET AL. 2001). 41.6% of winter athletes who sustained a head injury also sustained dental trauma (GASSNER ET AL. 2000, TULI ET AL. 2010).

Most skiing injuries occur through fall or collision with another skier (GASSNER ET AL. 2000). Individual risk for sustaining a skiing or snowboarding accident is two to six accidents per 1,000 ski days (HUNTER 1999, SHORTER ET AL. 1999, CORRA ET AL. 2004). Skiers and snowboarders are subject to different injury patterns. Skiers sustain more injuries to the lower extremities, especially to the knees, whereas snowboarders are more prone to injuries to the upper extremities, especially wrists (DAVIDSON & LALLOTIS 1996B, O'NEILL & MCGLONE 1999, DOHJIMA ET AL. 2001). Snowboarders sustain head injuries three to six times more often than skiers (FUKUDA ET AL. 2001, LEVY ET AL. 2002). Wearing a helmet with or without chin guard or a mouthguard could help prevent many head and dental injuries (RANALLI & DEMAS 2002, SULHEIM ET AL. 2006, FILIPPI 2009).

In the present study, the occurrence of accidents or dental trauma in amateur skiing and snowboarding and use of different types of protective gear was investigated.

### Materials and Methods

During one winter season (from 7 January to 18 April 2008), 500 male and female amateur winter athletes were interviewed in the ski region of Davos (Switzerland) using standardised questionnaires. A similar questionnaire has been used in other studies (LANG ET AL. 2002, PERUNSKI ET AL. 2005, PERSIC ET AL. 2006, FASCIGLIONE ET AL. 2007, MÜLLER ET AL. 2008). Interviewees were chosen randomly on date and time and each interview was conducted in person by one individual at the four base stations of the ski region (Parsenn, Jakobshorn, Rinerhorn and Pischa). Most interviews were conducted on a Saturday or Sunday. At the beginning of the interview it was briefly explained that this was a study about the occurrence of dental trauma on ski slopes. The questionnaires consisted of ten questions concerning dental injuries, use of a mouthguard, occurrence of ski or snowboard accidents, use of protective gear, rider's ability and riding frequency, and general questions about the individual (tab. I). One preprinted questionnaire containing ten questions was used for each interview. Questions were read aloud, additional explanations or translations for foreign tourists were given if necessary. Answers were marked by checks in the boxes and the whole interview lasted more than two minutes. Interviews were conducted until a total of 500 was reached (defined at the beginning of the study). Athletes who did not wish to participate were not specially recorded, of those, there were 60–80 individuals. The main reasons were no time or not in the mood.

Athletes were categorized as skiers, snowboarders, and those who rode both, as well as their origin, being locals of Davos, tourists from Switzerland, and tourists from abroad. Minimum age for inclusion was 16 years, determined at the beginning of the study, because only adults should be included.

Categorical data were summarized showing crosstables and the Chi-Square test was performed. To compare ordinal datas, Kruskal-Wallis rank sum test was performed. A *p*-value < 0.05 was considered as significant. All evaluations were performed using R version 2.12.0 (R DEVELOPMENT CORE TEAM 2009).

### Results

Of the 500 interviewed individuals, 345 were skiers, 110 snowboarders, and 45 rode both ski and snowboard. 288 (57.6%) were Swiss tourists, 126 (25.2%) locals, and 86 (17.2%) foreign tourists. A total of 258 males (51.6%) and 242 females (48.4%) were interviewed (tab. II).

The average age of all interviewed winter athletes was 37.8 years (16–83, SD 14.1 years); skiers were an average of 42.5 years old (16–83, SD 13.5 years), snowboarders 26.5 years (16–66, SD 9.1 years) and those who rode both 29.6 years (16–52, SD 8.4 years). Younger individuals preferred snowboarding or rode both, older individuals mostly skied (*p* < 0.001). In self-evaluation of rider's ability, 126 (25.2%) were advanced riders, 355 (71%) intermediate riders, and 19 (3.8%) beginners. Males often evaluated themselves as advanced riders, females more often as beginners (*p* < 0.001). The individuals had an average of 26.5 years of experience (skiers 31.5 years, snowboarders 12.1 years, and riders of both 23.3 years) (*p* < 0.001). Per season, the winter sport was practiced an aver-

Nr.	Question
1	Age
2	Gender (male/female)
3	Origin (locals/Swiss tourists/foreign tourists)
4	Type of winter sport (ski/snowboard/ski & snowboard)
5	Rider's ability (beginner/intermediate rider/advanced rider)
6	Riding quantity (experience in years/frequency in days per year)
7	Protective gear (yes/no) Type of protective gear (helmet, wrist guards, backguard, knee protectors)
8	Ski or snowboard accident sustained (yes/no) Type of accident (bone fracture, torn ligament, joint injury, concussion, strain/sprain)
9	Dental trauma (yes/no) Type of dental trauma (crown fracture, dislocation, avulsion, occlusal enamel fracture on posterior teeth)
10	Mouthguard (yes/no)

age of 20 days (skiers 17.6 days, snowboarders 20.2 days, riders of both 38.1 days) (*p* < 0.001). 87.2% (n = 436) of all interviewed individuals practiced their sport every year.

165 (33%) of the interviewed individuals have sustained a skiing or snowboarding accident, of those 58.8% males (n = 97, 37.6%) and 41.2% females (n = 68, 28.1%) (*p* = 0.031). Most accidents happened to advanced (n = 54, 32.7%) and intermediate riders (n = 110, 66.6%); only one beginner had sustained an accident (0.6%) (*p* = 0.002). Of advanced riders, 39 males (15.1%) and 15 females (6.2%) and of intermediate riders, 58 males (22.5%) and 52 females (21.5%) had sustained an accident in the past. Skiers sustained more bone fractures, snowboarders more ruptured ligaments and sprains/strains. Multiple answers to questions on type of injuries were possible (fig. 1).

Eleven (2.2%) winter athletes had sustained dental trauma (seven skiers, one snowboarder, and three who rode both). Their average age was 37.9 years (26–74, SD 15.1 years). Dental trauma occurred in eight locals, one Swiss tourist, and two foreign tourists (9 m, 2 f). Individuals who had sustained dental trauma practiced their winter sport an average of 32.5 years. High riding frequency correlated with occurrence of dental trauma (*p* < 0.001). Only advanced (n = 6) and intermediate (n = 5) riders had sustained dental trauma. The most frequent dental injury was crown fracture (n = 7), followed by dislocation (n = 3) and avulsion (n = 1).

		Locals	Swiss tourists	Foreign tourists	Total
Ski	Male	42	104	36	182
	Female	32	98	33	163
Snowboard	Male	15	28	9	52
	Female	20	36	2	58
Ski & Snowboard	Male	8	12	4	24
	Female	9	10	2	21
<b>Total</b>		<b>126</b>	<b>288</b>	<b>86</b>	<b>500</b>

All eleven individuals who had sustained dental trauma had also sustained another type of injury while practicing winter sports, but none at the same time as dental trauma occurred. Most common injury was bone fracture ( $n=5$ ), followed by torn ligaments and sprain/strain ( $n=3$ ), joint injury ( $n=2$ ) and concussion ( $n=1$ ). Nine of these used protective gear, two a mouthguard. One individual who had sustained dental trauma owned a mouthguard but only wears it for playing ice hockey. Overall, 27 (5.4%) owned a mouthguard used in other sports, such as boxing, ice hockey, handball, field hockey, martial arts, and motorcycle racing. None of the interviewees who had not sustained dental trauma wore a mouthguard in winter sports as a measure of caution.

Protective gear was used by 337 (67.4%) of all interviewees (172 males, 51%, and 165 females, 49%,  $p=0.790$ ). Females are protected a little bit better (68.2%) than males (66.7%). Helmets, back protectors and wrist guards were used most often. Multiple answers to questions on use of protective gear were possible (fig. 2).

Swiss tourists used protective gear most often ( $n=198$ , 58.7%), followed by locals ( $n=104$ , 30.8%) and foreign tourists ( $n=35$ , 10.4%) ( $p<0.001$ ). Intermediate riders protected themselves most with gear, beginners the least ( $p=0.003$ ). All athletes who had sustained an accident used protective gear ( $n=124$ ; 75.1%) ( $p=0.009$ ).

## Discussion

The present study concentrated on the occurrence of dental trauma on ski slopes, as well as the correlation of dental trauma and previously sustained accidents, rider's ability and riding frequency, as well as protective gear used.

Each interview was conducted personally and individually. Many athletes were surprised that dental trauma occurs in winter sports such as skiing or snowboarding.

2.2% of interviewees (11/500) had sustained dental trauma. This is comparable to an Austrian study with 2% (GASSNER ET AL. 2000). Incidence of dental trauma in skiing and snowboarding is low compared to other amateur sports (HUANG ET AL. 2009).

Dental trauma was sustained most often by locals with a high frequency of riding, though this was not statistically analyzed. The average age of 37.9 years shows that experienced winter athletes, especially skiers, sustained dental trauma. Possibly, locals are at a statistically higher risk for accidents because of higher riding frequency. Additionally, the mostly advanced level of ability in this group could be associated with higher riding velocity, and therefore also higher risk of accidents. This same tendency was also described in another Austrian study (TULI ET AL. 2010). The type of dental trauma most often sustained in skiing and snowboarding was crown fracture. These results are comparable to other studies on winter sports (GASSNER ET AL. 1999, TULI ET AL. 2010). Most dental injuries occurred in a fall. Collisions with ski lifts seem to be another common reason for dental trauma on ski slopes (GASSNER ET AL. 1999, GASSNER ET AL. 2000, TULI ET AL. 2010). Waiting in line for the ski lift seems to have potential for accidents with dental injuries, because of the close contact to other individuals, and skiers rearranging their ski poles. All interviewees who had sustained a tooth injury had also sustained another injury during winter sports. Dental trauma is often associated with other injuries, i.e. to the face. Two interviewees with dental trauma wore a mouthguard. 5.4% of all interviewed owned a mouthguard for another sport but did not use it in skiing or snowboarding. Two-thirds use protective gear. Helmets, back protectors, and wrist guards were used most often. These types of protective gear belong to standard gear used in winter sports. Helmets have become stylish accessories. In other literature, reduction of head injuries by 60% by wearing a helmet has been found (SULHEIM ET AL. 2006). In snowboarders, back pro-

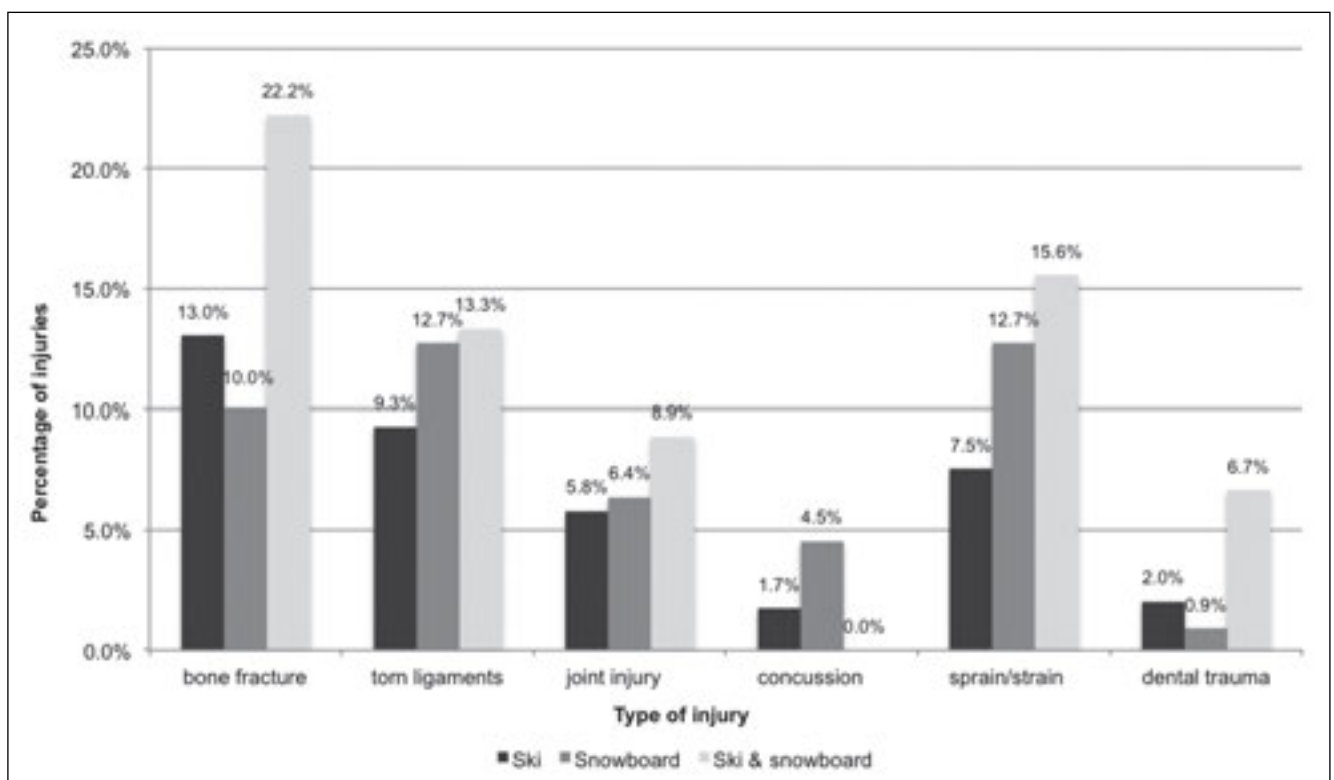


Fig. 1 Injuries in different types of sport

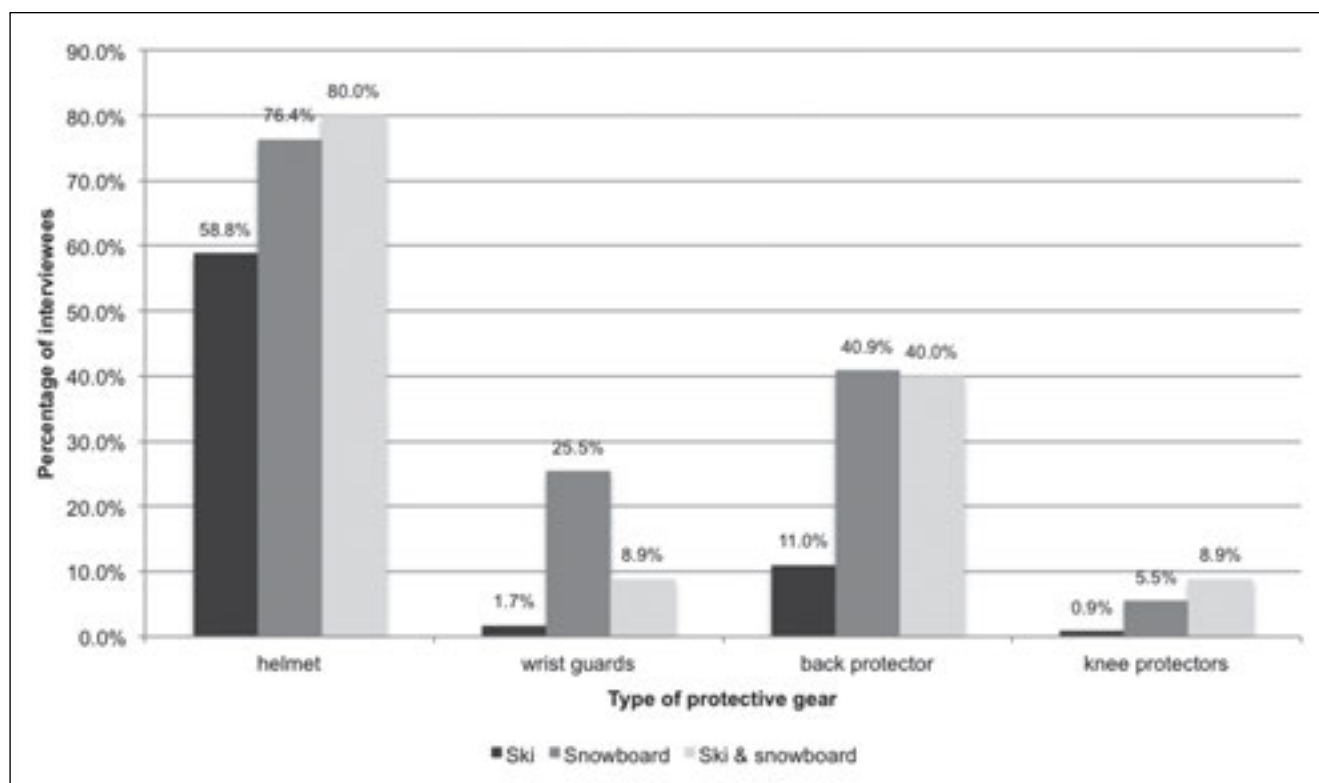


Fig. 2 Use of protective gear in different types of sport

tectors and wrist guards were common, because these body parts are especially susceptible to injuries from accidents. No protective gear was mostly used by individuals who had not sustained an injury yet, or by older individuals. One-third had already had a skiing or snowboarding accident. As in other studies, only intermediate and advanced riders had accidents (DAVIDSON & LALIOTIS 1996B). In other studies, up to 50% of beginners in snowboarding have accidents, in skiers there are much less accidents (DAVIDSON & LALIOTIS 1996A, FISCHLER & RÖTHLISBERGER 1996, MÜLLER ET AL. 2000).

Similar to other studies, skiers mostly sustained injuries to the lower extremities, snowboarders on the other hand to the upper extremities (HEIM ET AL. 1993, O'NEILL & MCGCLONE 1999, DOHJIMA ET AL. 2001). In the present study, bone fractures were the most common type of injury in skiers, sustained in falls. Snowboarders sustained more torn ligaments and sprains/strains, caused by standing sideways on the board and the absence of a security binding which opens on its own in case of a fall. In a snowboard fall, especially on impact, wrists are under much pressure and this often causes injuries. Knee injuries are the most common type of injury in skiing and constitute up to 36% of all ski injuries, according to literature (DAVIDSON & LALIOTIS 1996B, HUNTER 1999).

Skiing and snowboarding pose a low risk for dental trauma, compared to other known sports such as handball, basketball, squash, inline skating and mountainbiking with 4.5–16.6% (LANG ET AL. 2002, PERUNSKI ET AL. 2005, PERSIC ET AL. 2006, FASCIGLIONE ET AL. 2007, MÜLLER ET AL. 2008). To date, only few comparable studies have been conducted. Other injury locations are better documented, though, and protective gear should be designed and used to protect the rider from these injuries. Especially helmet wear should be made mandatory, although acceptance is already on the rise.

Although the risk for dental trauma in skiing and snowboarding is relatively low compared to other sports, the use of

a mouthguard may be considered not imperative, but is still recommended.

### Résumé

Les sports d'hiver comme le ski et le snowboard peuvent causer des accidents dentaires. Comme risques pour des accidents dentaires, on énumère les chutes, les collisions avec d'autres skieurs ou des remontes-pentes, les attentes aux remontes-pentes ou la manipulation des bâtons de ski. Dans la présente étude, la fréquence des accidents dentaires sur les pistes auprès de sportifs amateurs a été évaluée durant une saison d'hiver dans le domaine skiable de Davos (Suisse). En outre, les accidents de ski ou de snowboard ont été analysés, tout comme les vêtements de protection portés (protection dentaire incluse). 500 sportifs d'hiver ont été questionnés par hasard avec l'aide d'un questionnaire standardisé (258 hommes et 242 femmes), dont 345 skieurs, 110 snowboarders et 45 pratiquant les deux. L'âge minimum requis pour la participation à cette étude était de 16 ans. Chaque interview a été effectuée personnellement et individuellement par la même personne en avale des remontées mécaniques des stations du domaine skiable.

En tout, onze interviewés (9 m, 2 f; 2,2%) avaient déjà subi un accident dentaire en pratiquant un sport d'hiver. La fracture de couronne était la blessure la plus fréquente, et les skieurs assidus étaient surtout concernés par des accidents dentaires ( $p < 0,001$ ). 165 (33%) interviewés ont déjà eu un accident de ski ou de snowboard, les hommes plus souvent que les femmes ( $p = 0,031$ ). Les skieurs ont davantage souffert de fractures osseuses, tandis que les snowboarders ont souffert de blessures des ligaments ou de contusions/d'entorses. 337 (67,4%) personnes se protégeaient avec des vêtements de protection dont le casque était la protection la plus fréquente. Les snowboarders se protégeaient le mieux.

Deux des onze personnes qui avaient déjà subi un accident dentaire portent aujourd'hui une protection dentaire en faisant du ski ou du snowboard. Tous les sportifs d'hiver qui avaient déjà subi un accident ( $n = 124$ , 75,1%) portaient au moment de l'interview des vêtements de protection.

Dans cette étude, les résultats ont montré que les sports d'hivers comme le ski et le snowboard représentent un risque minime pour des accidents dentaires. Par contre, d'autres blessures sont plus fréquentes. Le conseil de porter une protection dentaire en faisant du ski ou du snowboard est difficile à justifier, si ce n'est chez les skieurs/snowbordeurs assidus.

## Zusammenfassung

Bei Wintersportarten wie Skifahren und Snowboarden kann es zu Zahnverletzungen kommen. Ein Risiko für Zahnunfälle stellen dabei Stürze, Zusammenprall mit einem anderen Skifahrer, Kollisionen mit Skiliften, das Anstehen an den Liften oder das Hantieren mit den Skistöcken dar. In der vorliegenden Studie, wurde die Häufigkeit von Zahnunfällen bei Amateursportlern auf Skipisten während einer Wintersaison im Skigebiet von Davos (Schweiz) evaluiert. Zusätzlich wurden Unfälle beim Skifahren oder Snowboarden untersucht, und es wurde aufgezeichnet, welche Schutzkleidung (inklusive Zahnschutz) getragen wurde. Es wurden zufällig 500 Wintersportler mittels eines standardisierten Fragebogens befragt (258 Männer und 242 Frauen), unter ihnen 345 Skifahrer, 110 Snowboarder und

45, die beides fuhren. Mindestalter für die Teilnahme an der Studie war 16 Jahre. Jedes Interview wurde persönlich und einzeln von der gleichen Person an den Talstationen der Bergbahnen im Skigebiet durchgeführt.

Es wurden insgesamt 11 Befragte (9 m, 2 f; 2,2%) gefunden, die bereits einen Zahnunfall erlitten hatten beim Wintersport. Die Kronenfraktur war die häufigste Zahnverletzung, und es waren die Vielfahrer, die vorwiegend von Zahnunfällen betroffen waren ( $p < 0,001$ ). 165 (33%) der Interviewten hatten bereits einen Ski- oder Snowboardunfall, Männer häufiger als Frauen ( $p = 0,031$ ). Skifahrer erlitten vermehrt Knochenfrakturen und Snowboarder vorwiegend Bänderverletzungen oder Prellungen/Verstauchungen. 337 (67,4%) der Befragten schützten sich mit Schutzkleidung, wobei der Schutzhelm am häufigsten getragen wurde. Snowboarder schützten sich am besten ( $p < 0,001$ ).

Zwei der elf Personen, die schon einmal einen Zahnunfall hatten, tragen heute einen Zahnschutz beim Skifahren oder Snowboarden. Alle Wintersportler, die bereits einen Unfall erlitten hatten ( $n = 124$ , 75,1%), trugen bei der Befragung Schutzkleidung ( $p = 0,009$ ).

In der vorliegenden Studie zeigten die Resultate, dass Wintersportarten wie Skifahren und Snowboarden ein geringes Risiko für Zahnunfälle aufweisen, andere Verletzungen stehen im Vordergrund. Das Tragen eines Zahnschutzes beim Skifahren oder Snowboarden ist höchstens für Sportler, die sehr häufig und schnell auf den Pisten unterwegs sind, zu empfehlen.

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