



Sport Activities, Oral and Dental Health. A Mutual Relationship

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Abstract

Objective: To review the relationship between sport activities, oral and dental health.

Material and Methods: A literature search was carried out through the Medline database (PubMed) and the Cochrane Controlled Clinical Trials Register. A subject-specific search strategy was conducted since the August of 2018 using the following keywords: sport drinks, energy drinks, sports oral health, mouthguard, oral anabolic Steroid, oral trauma, dental trauma, Barodontalgia, Odon-tecrexis, Sport Maxillofacial Injuries, Athletic injuries and Sports Medicine.

Results: Professional athletes are more prone to develop dental caries, compared to non-athletes. Despite the acknowledged effectiveness athletes are not compliant enough with the use of mouthguards. It is important doctors to be aware of dental-related problems that may arise, from pressure fluctuation, as it occur in scuba divers. People participating in sport activities has to be informed how to react in emergence situations, as only a small percentage of avulsed teeth are replanted, and most of them a long time after injury stored in inappropriate transport medium, as water.

Conclusions:

- Health professionals have to be aware of the correlation between oral health and sport activities
- Oral problems can be connected with inferior performance during exercise
- Health professionals have the responsibility to educate patients and the public about the importance of using mouth-guard protection in contact sports.

Keywords: Sports Medicine; Sports Oral Relationship; Sports Dentistry; Sport Oral Health

Introduction

Dentistry has become an integral part of the modern high-level sports medicine team. It is imperative that dentist must be aware of the sports medical team functions [1]. Dentists have to possess the specialized dental skills and knowledge, in order not only to prepare athletes for practice and competitions, but also to cope with an emergency dental trauma, prevent it and generally prevent the potential stresses on the dental tissues, coming from the athletes' sport diet habits, for instance energy drinks and nutritional [1,2].

Several sports activities present a high risk of injury to the face and teeth due to physical contact or conflict between players, direct ball and falling on a hard surface. The key to reduce injuries is to inform and raise awareness of all professional athletes participating in contact sports, as well as children starting at an early age to engage in sports. Extensive attention must be also paid to the reduction of potential predisposing factors and the proper use of mouthguards [3,4].

Athletic habits such as the nutritional habits and the energy drinks, affect oral health. A large percentage of people involved to occasional, or regular and prolonged sport exercise, appear to consume extensive quantities of sport and energy drinks [5]. A significant association exists between the dental erosive wear and high consumption of sour sweets and sports drinks [5].

Athletes may have poor oral health including high levels of dental caries, dental erosion and dental trauma. So it is imperative to update dental and sport practitioners' knowledge on the subject, as they are the main source, who can inform the athletes. The aim of the current review was to evaluate the relationship between sport activities, oral and dental health.

Materials and Methods

A literature search was carried out through the Medline database (PubMed) and the Cochrane Controlled Clinical Trials Register. The following eligibility criteria were used when considering studies for the present review:

- Study design: Clinical trials, epidemiological studies
- Outcomes of sport activities in oral health
- Influence of oral health to sport activities
- Sport related oral trauma.

Exclusion criteria

- Study design: Case reports, case series and narrative literature reviews.
- Absence of relationship between sport activities and oral health.

A subject-specific search strategy was conducted since the August of 2018 using the following keywords: sport drinks, energy drinks, sports oral health, mouthguard, oral anabolic Steroid, oral trauma, dental trauma, Barodontalgia, Odontocrexia, Sport Maxillofacial Injuries, Athletic injuries and Sports Medicine. No date or language restrictions were applied.

Data extraction

Papers potentially suitable for inclusion were selected initially based on their title and afterwards in their abstracts by two authors. A third author selected as coordinator, in order to help in possible disagreement between them. Data extraction was then carried out by two of the authors in duplicate and independently. Disagreements were resolved by discussion. Data extracted related

to the type of study, methodological quality, its impact to oral health and its possible association with sport performance.

Results and Discussion

Oral health

Professional athletes are more prone to develop dental caries, compared to non-athletes [5,6]. The energy demands of athletes, forms a dietary pattern which contains a frequently consumption of sugar, fermentable carbohydrates and sport drinks [1,6]. This along with the decreased salivary flow, as a result of dehydration and mouth breathing during sport exercise, increase the risk for dental caries and erosion [1,6,7].

There is also, a significant association between the dental erosive wear and high consumption of sour sweets and sports drinks. The athletes appear to have a more favorable health behavior compared with the other adolescents. However, athletes usually consume more fizzy/soft drinks and eat snacks containing sugar more often than the rest.

The athletes appear to have a more favorable health behavior compared to other adolescents. In scientific literature can be observed that a high percent of athletes, almost 37%, have ≥ 3 surfaces with dental erosions. An association between nutritional status, physical activity and dental trauma appear to lack truly causal relationship, but more evidence is needed to be validated [6,7].

Especially swimmers, are susceptible to dental erosion [8]. The acidic pH of the pools, in combination with ion under-saturated water are responsible for dental hydroxyapatite dissolution [8]. Even though the erosive effect of pool water seems to be less than that of the consumption of sport drinks, their combination can further increase dental erosion [10]. Pools must be carefully maintained and protected from acid sources, in order to reduce erosion's risk [11].

Individual attention must be paid to athletes with intellectual and physical disabilities.¹⁹ Special athletes present a higher occurrence of pain, untreated caries, missing permanent teeth and increased prevalence of periodontal diseases [1,2,12,13]. The high number of dental emergencies in Special Olympics events, reveal the necessity for more frequent oral evaluation and preventive dental care, which involve diet analysis, education, lifestyle and remineralization techniques [14]. Dentists have become to be aware of a correlation between oral health and sport performance [15]. Oral problems can be connected with inferior performance

during exercise, both directly, as pain distracts concentration, and indirectly through the influence of increased systemic inflammation and psychosocial stress [16]. The impact in second occasion, seems to be less evident to athletes, with a greater chance for underestimation [17].

Sport – energy drinks

Energy drinks claim to boost physical and mental performance, concentration, weight losing, extend endurance and reduce sleepiness. They contain high concentrations of caffeine or its extracts. Energy drinks consist of 50-550 mg caffeine, when a cup of coffee contains 77-150 mg [18]. They can also contain the amino-acid taurine, glucoronolactone, minerals and glucose [19]. Their consumption may lead to osteoporosis, increased risk of cardiovascular diseases, and during adolescence to caffeine overdose, loss of osseous mass, overweight and insomnia [20]. Children, pregnant and people with cardiac conditions are in higher risk [21].

Sport drinks are a particular type of soft drink that is usually rich in carbohydrates, minerals, electrolytes and flavorings [22]. They claim to prevent dehydration, provide energy and replenishment of electrolytes loss due to perspiration [20,21]. Sport drinks consumption at rest or low intensity exercise doesn't seem beneficial compared to water [22,23]. The substances and especially the carbohydrates contained in sport drinks are blamed for increased prevalence of dental caries and erosion [21,22]. Sport and energy drinks have been reported to have low pH and a high acid buffering capacity, provoking alterations in enamel [2-23]. Most athletes seem to consume sport drinks and according to a study dental erosions were identified in 40% of them [24].

Dental erosion is defined as the chemical removal of mineral from the tooth, enamel and root surface, without the involvement of microorganisms [25]. Histologically, during an acid attack, the phosphate, carbonate and hydroxyl ions are abstracted, leading to the dissolution of the hydroxyapatite crystals, which constitute the main components of enamel. This results in dissolution of the hydroxyapatite crystals and enamel's decalcification [23-25]. The low pH of energy and sport drinks can provoke to dentinal tubule exposure causing hypersensitivity or even in some cases pulp exposure or tooth fracture, when erosion extends to dentin [26].

The absolute erosive potential of a drink is difficult to be measured, as its impact varies among factors and conditions [27].

The low pH, the high titratable acidity (TA), the viscosity, the frequency and the duration of contact are some of the factors which influence the erosive potential of a sport drink [28]. Most sport and energy drinks have pH lower than 5.5, near the high risk limit of 4. The risk of dental erosion due to sport drinks, is dramatically increased after strenuous and prolonged sport activities, as these drinks are usually consumed when dehydration occurs and saliva flow is decreased almost 40% (after 2 hours of exercise). The coexistence of gastroesophageal reflux and systematic consumption of sports drinks creates an oral environment with even lower pH [5,25,28]. The rapid spread of energy and sport drinks in adolescents, due to their increasingly marketing, not only increase enamel's surface demineralization and plaque adherence, but also interfere with its "maturation", making teeth more prone to future acid and bacteria attacks, promoting dental caries and erosion [29-31].

The raise of energy-sport drinks pH has been investigated, in order to inhibit erosive and carious potential of them [31,32]. Increasing pH can lead to less acidic, bitter, taste and render beverage more prone to contamination with potentially pathogenic bacteria [31,32]. The addition of new ingredients like fluoride, magnesium, calcium, phosphate maleic acid, nano-hydroxyapatite and casein phosphopeptide (CPP-ACP) has also been introduced, with favorable results [33,34]. Further research has to be undertaken, to clarify which solution is more efficient with the least possible side effects.

Mouthguard

One of the main roles of a mouthguard is to prevent violent contact between upper and lower dentition. The effectiveness of mouthguards for preventing sport-related injuries from teeth, jaws and soft tissues is adequately established [35]. Despite the acknowledged effectiveness athletes are not compliant enough with the use of mouthguards [36]. One of the main reasons athletes are not compliant with the use of a mouthguard, is the inappropriate fit of the mouthguards. Most of them are "boil and bite" manufactured in one size [36]. Many sport dentists have stated that a large amount of uncomfortable and inappropriate mouthguards are still used [37]. Apart from the bad fit, interference with breathing and speaking, these mouthguards can result in temporomandibular disorders especially if they are used for many hours.

Custom-fabricated mouthguards offer the best possible fit, the maximum protection from injury, interfering the least with

breathing and speech [38]. The thickness rather than the location of the anterior palatal margin of the mouthguard, seems to have a significant influence on the reduction of tooth deflection against a horizontal blow [39,40]. Its thickness must not be less than 1,8 mm in its thinnest point [41]. Over the labial surface of anterior teeth requires a thickness of 3.0-4.0 mm and over the buccal surface of posterior teeth requires a thickness of 2.0-3.0 mm [41]. Mouthguards should be examined on a regular basis to ascertain they have not lost their characteristics.

Orthodontic appliances are one of the major factors for maxillofacial injuries during sport [42]. Yet, orthodontic treatment cannot be regarded as an obstacle for a mouthguard use, as there are special techniques by which good retention and pressure control to the orthodontic appliances can be achieved [43,44].

Despite of the confirmed effectiveness of mouthguards for protecting the teeth, oral soft tissues, and jaws of athletes, less conclusive evidence exists to support the contention that mouthguards are effective in reducing or eliminating mild traumatic brain injuries [45]. A concussion has been described in clinical terms as a syndrome characterized by immediate and transient post-traumatic impairment of neural function, such as alteration of consciousness or disturbance of vision or equilibrium, and other symptoms and signs because of the involvement of the brain stem. In contact sports a survey states that one in twenty players experience a concussion during a season [47]. The most common cause of a concussion during sport events is a blow to the mandible [47,48]. In this way, mouthguards might have a preventing role against concussions, by the dissipation of forces delivered to the temporomandibular joint, maxilla and skull [49].

First Author	Country	Age Group (Mean)	Sport	Use of mouthguard	Year of study
Kroon J	Australia	<15 (11.2)	Rugby	68.2% 340/499	2016
O'Malley M	Ireland	9-13 (10.91)	Gaelic football, soccer, camogie, hurling, rugby, basketball	22% 11/505	2016
Vidovic D	Croatia	8-29 (15)	Taek-won-do	96% 465/484	2015
Uzel I	Turkey	11-21 (15.11)	Soccer	0.26% 1/343	2014
Tiwari V	India	12-22	Hockey, Shooting, Karate, Boxing, Judo, Canoeing & Kayaking, Wushu, Fencing, Horse riding, Wrestling, Tycondo, Rowing, Sailing	25% 80/320	2013
Emerich K	Poland	(17.6)	Boxing	43.3% 145/338	2013
Sepet E	Turkey	Up to 18	Basketball, Swimming, Volley-ball, Soccer, Tennis, Badminton, Handball, Athleticism, Golf, Gymnastics, Water polo, Karate	11.2% 40/359	2012
Boffano P	Italy	13-39 (22.1)	Rugby	53.8% 35/65	2012
Cătălina F	Romania	6-13 (10.24)	Gymnastics, Tennis, Tae-kwon-do, Rugby, Football, Judo, Karate, Sports dance, Table tennis, Basketball, Fencing	0% 0/348	2012
Ilia E	Australia	18-51 (24.12)	Rugby	76.9% 173/225	2010-11
Lesic N	Croatia	19-49 (16.6)	Basketball	1% 2/195	2011
Biagi R	Italy	8-15	Soccer, Martial arts, Tennis, Swimming, Volleyball, Basketball, Cycling	5% 10/200	2010
Collins CL	USA	15.9	Basketball, Baseball, Softball	12.3% 158/1263	2009-10
Maxen M	Switzerland Sweden	(22.5)	Floorball	0.7% 2/285	2009-10
YeşilDuymuş Z	Turkey	17-29 (21.68)	Basketball, Volleyball, Soccer	0% 0/768	2009

Neussl A	USA	19-25	Ice hockey	67.3% 217/324	2008
Tin-Oo MM	Malaysia	12-27	Badminton, Squash, Gymnastics, Silat, Track and field, Table tennis, Cycling, Tennis, Sepaktakraw and Wushu	0% 0/180	2008
Frontera R	Brazil	(23.12)	Basketball	7% 27/388	2006-07
Caglar E	Turkey	(23.5)	Football	68.6% 46/67	2007
Fakhrudin K	Canada	12-14	School sports	5.5% 14/252	2007
	Canada	12-14	League sports	20.2% 51/252	2007
Raaii F	Canada	9-12	Ice hockey	68% 122/180	2007
Spinas E	Italy	8-11	Basketball	1% 3/300	2006
Cetinbas T	Turkey	University students	Ice hockey, Football, Karate	73.3% 66/121	2006
Tozoglu S	Turkey	17-27	Boxing, Taekwondo	55.8% 153/274	2006
Persic R	Switzerland Germany, France	10-75 (30.3)	Squash	21.3% 472/600	2006
Perunski S	Switzerland	(22.28)	Basketball	1.3% 4/302	2005
Kececi AD	Turkey	(24.36)	Taekwondo, Handball, Volleyball	4.1% 7/162	2003-04
Quarrie KL	New Zealand	-	Rugby	67% 240/327	1997
				93%	2003
Caglar E	Turkey	(18.8)	Ice hockey	10.8% 4/37	2003
Lieger O	Switzerland	(26)	Handball, Ice hockey, Basketball, Soccer	16% 43/267	2002-03
Berry DC	USA	(20.99)	Ice hockey	88% 139/151	2002-03
Chatterjee M	United Kingdom	-	Rugby	76% 23/30	2002
Onyeaso C	Nigeria	12-19 (15.18)	Soccer, Basketball, Tae-kwon-do, Judo, Table tennis, Long tennis, Badminton, Lawn Tennis, Handball, Swimming, Gymnastics, Box, Volleyball, Hockey, Snookers, General sports	19.6% 220/1,127	2002
Lang B	Switzerland Germany	(27.05)	Handball	10.2% 10/98	2002
Braham RA	Australia	(22.3)	Football	73.6% 203/301	2000
Cornwell H	Australia	12-15 (13.5)	Basketball	30% 64/208	2000
	Australia	18≤ (30)	Basketball	21% 61/288	2000
Muller-Bolla M	France	(26.42)	Rugby	64.2% 733/1140	1999-00
Banky J	Australia	-	Football	72% 692/961	1999
McClelland C	United Kingdom	20-26	Hockey, Rugby, Squash, Football, Box	68% 15/22	1999
Kvittem B	USA	High School	Soccer, Wrestling, Basketball	5.3% 16/283	1996-97

Chapman PJ	Australia	13	Rugby	81% 13/16	1996
	Australia	14-15	Rugby	10034/34	1996
	Australia	16	Rugby	9416/17	1996
	Australia	17	Rugby	10063/63	1996
Yamada T	Japan	16-17	Soccer, Rugby	0.8% 9/2670	1993-94
Chapman PJ	Australia	(26.4)	Rugby	84.6% 26/31	1991
	Scotland	(27.9)	Rugby	84.6 % 26/31	1991
	Wales	(25.7)	Rugby	72.9% 24/33	1991
	Ireland	(27.4)	Rugby	84.6% 26/31	1991
Nowjack-Raymer RE	USA	7-17	Soccer, Football, Baseball/Softball	7%, 72%, 7%	1991
Jennings DC	UK	19-45 (25.4)	Rugby	52.6% 54/60	1990
Maestrello-deMoya	USA	High School	Basketball	4.2% 43/1020	1989
Chapman PJ	United Kingdom (Australian team)	(24.3)	Rugby	92.8% 26/28	1986
	United Kingdom (British Team)	(24.1)	Rugby	25% 7/28	1986

Table 1: Use of mouthguards.

Dental orofacial trauma

A significant relationship between sports activities and permanent incisor crown fractures exist, especially for children. Increased overjet of anterior teeth was found to be associated with incisor injury [50]. People participating in sport activities has to be informed how to react in emergence situations, as only a small percentage of avulsed teeth are replanted, and most of them a long time after injury stored in inappropriate transport medium, as water [51]. A standardized kit, with most practical instruments and materials in order to handle dental injuries, must be available in all sport clubs and schools [46,47]. Immediate replantation or maintenance of the avulsed tooth in storage media compatible for the survival of periodontal ligament cells before replantation is fundamental to a successful replantation procedure. However, debris removal must be carefully realized in order to avoid further damaging of the periodontal ligament fibers in the alveolar process, since these are important for replanted teeth repair. There are six simple rules for managing traumatic dental injury:

- Locate the tooth as quickly as possible
- Handle the tooth only by the crown (the white part)
- Replace the tooth in its socket immediately (see the adjacent teeth as a guide)
- Immobilize any loosened teeth
- If the tooth cannot be replanted, immediately place it into a physiological medium, (e.g. use milk, saline or even saliva—place the tooth between the cheek and the lower molars)
- Attend a dentist as soon as possible.

All jewelry, especially intraoral piercing, are mandatory to be removed during sport events [52]. During physical activity, the increased blood flow, respiration rate in combination with the high chance of bleeding, lead to a raised infection risk. Intraoral position of cosmetic objects can induce in gagging or inhibition of breathing and speaking, as they stimulate saliva production. If they are loose, they can result in a aspiration, choking or swallowing. Last but not least, oral piercing obstructs the proper fit and function of mouthguards [53].

First Author	Cases Number	Country	Age Group	Causes of trauma	Trauma	Year of study
Dursun E	96 9.8%	Turkey	20-55	Soccer	Orofacial, Dental 7.2%	2014
Lexomboon D	478 2.2%	Sweden	8-10	20.6% Sports Physical exercise, Gymnastic, Fitness, Floorball, Football, Ice hockey, Skiing, basketball etc.	Tooth F	2011-2013
Sekulic M	82 86%	Switzerland	26-30 Prevalent group	Hooligans	Loosened tooth 7.5%, Chipped tooth 7.5%, Broken tooth 42.5%, Displaced tooth 9.5%, Avulsion 12%	2012-2013
Chopra A	86 10.1%	India	12-15	Sports 41.9%	Enamel F 80.2%, Enamel-Dentin F 8.1%	2013
Schildknecht S	35 6.8%	Switzerland	10-47 (23.1)	Rugby	Crown F 74%, Dislocations 2.5%, Avulsions 0.8%	2010-2011
Ilija E	146 64.9	Australia	18-51 (24.12)	Rugby	Orofacial, Dental 41.9%, Avulsion 5.81%, Luxation 12.40%, Crown or root fracture 15.89%, Bleeding socket 7.75%	2010-2011
Azodo CC	156	Nigeria	(23.1)	Basketball	Lip 39.9%, Multiple orofacial sites 25.4%, Cheek 19%, Forehead 7.9%, Nose 3.2%, Eye 3.2% Lower Jaw 1.6%	2009-2010
Maxen M	57 11.3%	Switzerland Sweden	(22.5)	Floorball	Crown F 45.6%, Concussions 22.1%, Dislocation 16.2%, Temporomandibular 8%, Mandibular F 3%	2009-2010
Abdullah D	456	Malaysia	16< (22.73)	Rugby	Tooth F 19.3%, Luxation 6.6%, Avulsion 1.1%	2009-2010
Prabhu A	106	India	10-16	58% Sports	Enamel F 51.8%, Dentin F 40.4, Complicated crown F 2.4%, Tooth discoloration 0.6%, Avulsion 0.6%	2009-2010
Emerich K	121 35.8%	Polish	13-32	Box	Crown F 40.7%, Avulsion 21.9%, Soft and hard oral tissue Injuries 37.4%	2010
Welch Cl	476,518 claims	New Zealand	0-61+	27.3% Rugby, 16.2% Water Sports, 7.2% Cycling, 6.9% Soccer, 4.8% Basketball, 4.6% Skating, 4.3% Hockey	Dental	1999-2010
Bucher K	219	Germany	1-68	Bicycle, Skiing, Snowboarding, Sledding, ice skating, ball games, swimming	Dental F 63.8%, Luxation 36.2%	2004-2008
Caglar E	17 19.7%	Turkey	13-29	Snowboard	Orofacial, 9.5% Dental	2008
Fakhruddin K	107 25.9%	United Arab Emirates	18-22	11% Sports	Dental	2008
Stewart C	94	Ireland	5-17 (10.1)	23.2% Sports	Uncomplicated crown F 23.2%, Complicated crown F 10.7%, Root F 5%, Luxation 22%, Extrusion 5%, Intrusion 4.2%, Avulsion 17.7%	2008
Mori G	88 28.4%	Brazil	50.4% 20-40	Soccer, Jiu-jitsu, Mountain biking, Handball, Volleyball	Crown F 41.9%, Avulsion 5.64%, Cuts of the lip 23.94	2007
Ferreria M	681 86.2%	Brazil	(25.75)	20.5 Sports	Dental F 24.5%, Concussion 22.1%, Luxation 2%, Avulsion 19.4%	2005-2007

Thelen D	276 9.8%	Albania	16-19 17.5	14.1% Sports Running, Cycling, Swimming, Diving ea.	Dental	2006
Frontera R	194 50%	Brazil	(23.2)	Basketball	Dental 69.7%, Mandibular 20.1%, Soft tissues 60.8%	2006- 2007
Tozoglu S	53	Turkey		20.8% Soccer	Dento-alveolar fractures 36%, Tem- poromandibular joint disorders 27%, Mandibular fractures 27%	2006
Antoun J	2582	New Zealand	(26.2)	21.7% Sports Related	41.4% Mandibular F	1996- 2006
Tozoglu S	11	Turkey	18-24 (20.7)	Soccer	Dental alveolar F 36%, Temporoman- dibular joint disorders 27%, Mandibu- lar F 27%, Nasal F 9%	2005
Lam R	528	Australia	0-78 88.3% 7-14	15.8% Sports	Uncomplicated crown F 0.2%, Res- toration fracture 2.3%, Root F 3.0%, Complicated crown F 9.9%, Uncompl- icated crown F 32%, Concussion 5.7%, Avulsion 6.1%, Luxation 30.8%	2000- 2005
Locker D	303 15.5%	Canada	18-50	18% Sports	Orofacial, Dental 13.1%	2005
Love RM	1287	New Zea- land	2-86 (17.48)	16.3% (Permanent teeth) Rugby, Skating, Swimming, Cricket, Softball, Baseball, Jockey, Soccer, Bicycling. Bas- ketball ea. 4.55% (Primary teeth) Softball, Baseball, Bicycling, Soccer, Cricket, Swimming, Skating, Hockey	Primary tooth: Concussion 51%, Luxation 27%, Uncomplicated crown F 11%. Permanent tooth: Concussion 53%, Uncomplicated crown F 28%, Luxation 10%, Complicated crown F 3%, Avulsion 3%, Root F 1%, Intru- sion 0.2%, Enamel crack 0.1%, Extru- sion 0.05%	2000- 2004
Kececi AD	32 19.7%	Turkey	(24.36)	Taekwondo 24%, Handball 25.8, Volleyball 8%	Crown F 24%, Dislocation 8.5%, Avul- sion 5%, 58%	2003- 2004
Huang B	1259 19.9%	Taiwan	15-18	30.8% Sports	Anterior tooth trauma	2002- 2003
Hecova H	384	Czech Republic	7-65 66% 7-15	26% Sports	Tooth F 44.1%, Luxation 42.2%, Avul- sion 6.5%, Concussion 1.6%	1997- 2002
Castro JC	293	Brazil	11-18 Prevalent group	37% Sports	Enamel F 15.8%, Dentin F 39.9%, Complicated crown F 27.5%, Uncomplicated crown-root F 16.8%	1992- 2002
Bak MJ	38	USA	5-50 (24.2)	Baseball, Softball	Midface F 46%, Skull F 31%, Mandible F 23%	1991- 2002
Brunner F	23000	Switzerland	14-72 (37)	18.7 / 19.8% Sports (Soccer, Ice Hockey ea.)	Uncomplicated crown F 31/27%, Complicated Crown F 9/6%,	1992 & 2002
Mourouzis C	125	Greece	8-52 (24.2)	Soccer, Basketball, Taekwon- do, Skiing, Jogging, Gymnas- tics, Cycling, Boxing, Hockey, Horse Driving	Orofacial 9.5%	1996- 2002
Rahman R	313	Malaysia	1-67 (23)	0.6% Sports	Orofacial	1998- 2002
Ferreira P	581	Portugal	<18 (13.5)	3.8% Sports	Mandibular F	1993- 2002

Delilbasi C	1428	Japan	8-62 40% 10-19	7% Sports Baseball, Rugby, Soccer, Basketball, Golf, Tennis, Handball	Maxillofacial	1986-2002
Motamedi MH	237	Iran	3-73 59% 20-29	6.3% Sports	Mandibular 72.9%, Maxillary 13.9%, Zygomatic 13.5%, Zygo-matico-orbital 24%, Cranial 2.1%, Nasal 2.1%, Frontal 1.6%	1996-2001
Kargul B	446	Turkey	1-12 (7.87)	12.31% Sports, Basketball, Bicycles, Football, Roller skate, Swimming pool	Primary teeth: Avulsions 30, Craze lines 16, Uncomplicated crown F 52, Complicated crown F 17, Intrusion 17, Luxation 10, Root F 2, Extrusion 3. Permanent teeth: Avulsions 45, Craze lines 45, Uncomplicated Crown F 408, Complicated Crown F 75, Intrusion 17, Luxation 21, Root F 8, Extrusion 13	1999-2000
Muller-Bolla M	788 25.97%	France	(26.4)	Rugby	Dental 69.2%, Soft tissue 2.7%, Bone and TMJ 28.04%	1999-2000
Gassner R	9543	Austria	1-99 (25.8) 50% 10-37	31% Sports	Soft tissue 27.4%, Facial bone F 10%, Bone F 27.4%, Dentoalveolar 33.6%, (Crown F 37.8%, Root F 2.8%, Luxation 47.9%, Avulsion 7.1%, Intrusion 2.5%, Concussion 1.9%)	1991-2000
Chan YM	288	New Zealand	0-10	10% Sports	Orofacial	1999-2000
Caldas AF	250	Brazil	1-59 51% 6-15	3.6% Sports	Enamel F 51.6%, Dentine F 40.8%	1997-1999
Gabbe B	320	Australia	17-35 (22.9)	Football	10% Orofacial	1999
Wood EB	197	Australia	1-64 86% <20	31% Bicycling, Skating, Rollerblading, other sports	Tooth F 59%, Luxation 28%, Concussion 16%, Avulsion 9%, Extrusion 7%, Mandible/Maxilla F 6%, Alveolar process Fracture 5%	1998
Gassner R	2874 47.9%	Austria	(17.8)	34.6% Sports	Crown F 37.5%, Root F 2.5%, subluxation 50.6%, Avulsion 7.4%, Concussion 2%	1991-1997
Banky J	-	Australia	-	Football	Concussion 20-31%, Facial bone F 12-25%, Dental <2%	1992-1996
Persson LG	26	Sweden	16-37 (23)	Wrestling	Enamel F 66.7%, Uncomplicated crown F 15.2%, Root fractures 6.1%, Infractions 6.1%, Complicated crown F 6.1%, Extracted tooth 3%	1994
Tanaka N	89	Japan	10-29 Prevalent group	Rugby, Ski, Baseball, Soccer ea.	Mandible, Alveolar	1977-1991
Ferrari Ch	342 28.8%	Brazil	18-30 (13.3)	Martial arts 32.1%, Hockey 11.5%, Basketball 36.4%, 37.1%, Soccer 23.1%	Orofacial	1998-1991
Singh G	335 30.3%	India	8-16	Basketball, Cricket, Bicycling, Skating, Hockey, Kho-Kho, Handball, Football, Athletics, Boxing, Tennis, Badminton, Judo, Tae-kwon-do	Soft tissue injuries 48.1%, Tooth F 43%, Tooth discoloration 6.3%, Lateral dislocations 1.5%, Avulsion 1.2%	-

Fasciglione D	56 9.2%	Switzerland Germany	<50 (31.2)	Rollerblading	Crown F 64.3%, Dislocations 30.4%, Avulsions 5.3%	-
Müller KE	27 5.7%	Switzerland, Austria, Germany, Italy	9-66 (30.88)	Mountain bike	Crown F 4.2%, Dislocations 1.1%, Avulsions 0.8%	-
Hersberger S	87 21%	Switzerland	14-63 (29.6)	Water Polo	Tooth F 16.4, Avulsion 1.4%, Dislocation 3,4%	-
Persic R	27 4.5%	Switzerland	10-75 (30.3)	Squash	Crown F 74.1%, Avulsion 22.2%, Dislocation 3.7%	-
Sgan-Cohen HD	22 32.2%	Jerusalem	9-13 95% 10-12	27.3% Sports at school 34.2% Sports outside	Orofacial	-
Sgan-Cohen HD	153 33.8%	Jerusalem	10-12	16.4% Sports	Orofacial	-
Ozbay G	41 19.3%	Turkey	6-14 (12)	Handball	Concussion 70%, Crown F 12%, Luxations 9%, avulsions 6%, Soft-tissue 3%	-
Perunski S	55 16.6%	Switzerland	(22.28)	Basketball	Crown F 76%, Dislocations 13%, Combined 7, Avulsions 4%	-
Tolunoglu I	61 22.3%	Turkey	17-27	Taekwondo, Box	Dental	-
Kay EJ	62 98%	Scotland	14-40	Rugby	Tooth F 30%, Avulsion 19%, Soft tissue 40% Mandibular F 5%	-
Hendrick K	75 68%	United Kingdom	51% 20-25	Hockey	Bone F 11%, Loosened tooth 10%, Tooth F 3%, Avulsion 5%,	-
Lesic N	2615	Croatia	16-49	Basketball	Orofacial, Dental 2.2%	-
Malikaew P	954 35%	Thailand	11-13	6.9% Sports Soccer, Swimming	Uncomplicated tooth F 87.8%, Complicated tooth F 1.4%, Enamel cracks 2.7%	-

Table 2: Sports-related orofacial injuries.

An overall lack of knowledge about dental trauma and highlight the need of special programs designed to educate school-aged students about emergency procedures to handle cases of dental trauma. There is a need for education programs and the future implantation of an information and training program in first-aid procedures regarding tooth avulsion, directed at physical education teachers and students at all teaching institutions. Information campaigns including television, newspaper campaigns, distribution of brochures and posters, lectures, and more importantly Web-based could also be useful strategies for the prevention of traumatic dental injuries.

Effects of anabolic androgenic steroid (AAS)

Anabolic androgenic steroid, the synthetic substitute of male sex hormone is the most popular drug, both among professionals

and amateurs [54]. The abuse of Anabolic androgenic steroid is associated with pathological conditions, which can result in oral health disorders, as significant gingival enlargement, increased prevalence of temporomandibular joint disorder, xerostomia, dental caries and oral candidiasis [55]. The use of AAS can alter masticatory structures and increase the incidence of TMD and the severity of bruxism, especially before and during stress periods. Anabolic abusers seem to present significant gingival enlargement regardless of the plaque and gingival inflammation [55,56]. Even though, many of the adverse effects due to anabolic drugs are reported to be fully reversible, after their discontinuance, a prospective regression of gingival enlargement is uncertain. The use of anabolic androgenic steroids, can lead to various psychiatric and behavioral side effects, which constitute significant risk

factors for the periodontal disease [56,57]. There is also, a greater susceptibility for coagulopathy and reduced healing potential of the soft tissues during surgical procedures, as third molar extractions or surgical placement of dental implants [57].

Barodontalgia

It is important for dentists to be aware of dental-related problems that may arise, from pressure fluctuation, as it occur in scuba divers. In scuba tanks, oxygen's natural diluent gas, nitrogen, is replaced by helium, resulting in a gas of lower viscosity that can enter tissues, including teeth, and sometimes become trapped in closed spaces, such as the pulp chamber and root canal. Gas can also be trapped in spaces between tooth and restoration. Then the trapped gas could expand and cause tooth fracture. This phenomenon is called Odontocrexia. Teeth with inferior quality restorations seem to suffer significant tooth damage on de-compression when compared with unrestored teeth either in the presence or absence of dental caries [58].

9.2%-21.6% of American and Australian SCUBA divers have experienced barodontalgia with a weighted average 11.9%. Odontocrexia is uncommon as has been reported by less than 1% of the divers. Faulty dental restorations, dental caries without pulp involvement, pulp inflammation and recent dental treatment are the most common causing factors [59].

For prevention of dislodgement and aspiration, patients should be advised not to dive while having provisional restorations. It is better not to dive shortly after having a new restoration placed, especially not a deep dive, because pressure in the pulp cavity can be increased by a slight degree of inflammation causing pain [60].

Conclusions

Dentists have to be aware of the correlation between oral health and sport performance. Oral problems can be connected with inferior performance during exercise, both directly, as pain distracts concentration, and indirectly through the influence of increased systemic inflammation and psychosocial stress. There is a need for education programs and future implantation of an information and training program in first-aid procedures regarding tooth avulsion, directed at physical education teachers and students at all teaching institutions. Dentists of all specialties, including pediatric and general dentists, could provide education to parents and patients regarding prevention of orofacial injuries as part of the anticipatory guidance discussed during dental visits.

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