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Mouth guard use and the incidence of orofacial injuries : a survey of athletic trainers

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Mouth Guard Use and the Incidence of Orofacial Injuries:
A Survey of Athletic Trainers

A Project
Presented to
The Faculty of the Department of Human Performance
San Jose State University

In Partial Fulfillment
Of the Requirements for the Degree
Masters of Arts

By
Meredith A. Dillon
August 2000

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Abstract

Mouth Guard Use and the Incidence of Orofacial Injuries:

A Survey of Athletic Trainers

by Meredith A. Dillon

Despite the benefits of mouth guards, children, adolescents, collegiate athletes, and professional athletes across the nation seldom wear this protective device. The purpose of this study was to investigate certified athletic trainers' (ATCs) knowledge and attitudes towards mouth guards and identify the corresponding orofacial injury rate. Three hundred and seventy four ATCs in the state of California who worked in either the high school, collegiate, or professional levels, were surveyed on knowledge of mouth guards and injury rate at their institution. Certified athletic trainers were given the Mouth Guard Knowledge Survey (MGKS) containing 25 questions on mouth guard knowledge, opinion, and incidence of orofacial injury during the 1998 to 1999 academic year. Descriptive statistics including means, medians, modes, frequency tables, and cross tabulations were used to analyze ATC knowledge questions and demographic information. Athletic trainers had a good working knowledge of mouth guard use, risks, compliance, and type; however, responses related to mouth guard compliance indicated that the majority of ATCs do not attribute mouth guard use or compliance to any one faction of the athletic team (coaches, athletes, parents, or ATCs). When cross tabulations were conducted, 46% (n= 78) of ATCs who understand that mouth guards protect against injury, do not dispense mouth guard information to their athletes prior to their first practice. Mouth guards are an important piece of protective equipment, but

accountability for mouth guard compliance and knowledge dissemination appears to be lacking. Therefore, ATCs should consider implementing a system for mouth guard compliance at their institution.

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Mouth Guard Use and the Incidence of Orofacial Injuries:

A Survey of Athletic Trainers

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Mouth Guard Use and the Incidence of Orofacial Injuries:

A Survey of Athletic Trainers

Abstract

Objective – The objective of this study was to investigate certified athletic trainers knowledge and attitudes towards mouth guards and to identify the corresponding orofacial injury rate.

Design and Setting – The Mouth Guard Knowledge Survey was mailed to certified athletic trainers in the state of California. Athletic trainers worked in either the professional, collegiate, or high school setting.

Subjects – Three hundred and seventy four certified athletic trainers in the state of California.

Measurements – Descriptive statistics were calculated to ascertain athletic trainers knowledge of mouth guards. Cross tabulations were done to compare knowledge questions with actual practice questions.

Results – Athletic trainers had a good working knowledge of mouth guard use, risks, compliance, and type. However, responses related to mouth guard compliance indicated that the majority of ATCs do not attribute mouth guard use or compliance to any one faction of the athletic team (coaches, athletes, parents, or ATCs). When cross tabulations were conducted, 46% (n= 78) of ATCs who understand that mouth guards protect against injury, do not dispense mouth guard information to their athletes.

Conclusion – Accountability for mouth guard compliance and knowledge dissemination appears to be lacking. The large number of orofacial injuries were reported in this study indicates a need to reduce or control their occurrence. Since one professional domain of athletic training is the prevention of injury, then the ATC should be responsible for creating a system for mouth guard compliance at their institution.

Key Terms – Mouth guard, orofacial injury, concussive injury, responsibility, prevention.

Introduction

Mouth guard use has been identified as an integral component in the protection and injury reduction of teeth, face, and head injuries.^{1,2} Research from the American Dental Association suggests that with the use of mouth guards and face guards, nearly 200,000 orofacial injuries are prevented in football each year, particularly when custom mouth guards are used.²⁻⁶ Despite the noted benefits of mouth guards, children, adolescents, collegiate athletes, and professional athletes across the nation seldom wear this protective device.⁷

The function of mouth guards is to protect against face, head, and teeth injury. Mouth guard protection to the teeth and gums is afforded by preventing lacerations and soft tissue damage.¹ Certified athletic trainers (ATCs) are responsible for the prevention of injuries as part of the delineated professional domains. Thus, if athletic trainers are responsible for delivery of mouth guard use and knowledge to athletes to prevent injury, then they should understand the impact of their use in both collision and non-collision sports. Research on knowledge and attitudes towards mouth guards has been collected from a variety of subject groups including coaches, athletic trainers, officials, athletes, and parents with a myriad of responses indicating a lack of continuity pertaining to who is responsible for mouth guard information dissemination and compliance.⁷⁻¹¹ Results from an inquiry by Ranalli and Lancaster suggest that the coaches believe ATCs are responsible for determining the type of mouth guard used by the team.¹¹ In this study, 56% of the respondents indicated the athletic trainer was responsible for determining the type of mouth guard, while 36% identified the athletic trainer and additional personnel as

the responsible parties. Coaches were asked who had the greatest influence on player compliance, and indicated themselves 26% of the time and the athletic trainer 14% of the time.¹¹ Seals et al. (1985) concluded that the athletic trainer was held responsible 30 % of the time for mouth guard use among athletes.⁸ These studies indicate that responsibility for mouth guard compliance and information dissemination needs to be better defined in the athletic area if the prevention of injuries and reduction of the current injury rate is desired.

The lack of accountability for information dissemination from coaches, athletes, and athletic trainers regarding the benefits of mouth guard use may be one issue contributing to noncompliance.⁷⁻¹¹ If athletic trainers are to contribute in the prevention of injuries through mouth guard use, then they should be knowledgeable in this area. Therefore, the purpose of this study was to investigate certified athletic trainers knowledge and attitudes towards mouth guards and identify the corresponding orofacial injury rate.

Methodology

Three hundred and seventy-four ATCs in the state of California were surveyed on knowledge of mouth guards and injury rate at their institution. The ATCs were employed in four settings, high school (31.5%), junior college (25.3%), university (35.3%), and professional setting (8.0%). Certified athletic trainers in the clinical setting were excluded for the purposes of this study. A Human Subjects review for the Protection of Human Subjects was approved by San Jose State University.

Survey Instrument

The Mouth Guard Knowledge Survey (MGKS) was developed and modified for this study based on current research and a similar survey on mouth guard knowledge.¹² Professional athletic trainers and dentists knowledgeable in sports dentistry partook in two pilot studies to assess content validity. Modifications to the survey were made based on the expert opinions. The MGKS had a total of 25 questions. Twelve questions were designed to ascertain athletic trainers' knowledge of mouth guards using Yes and No answers. Eleven questions assessed athletic trainers' opinion regarding various mouth guard topics using a five point Likert scale where: one corresponded to "strongly agree" and 5 corresponded to "strongly disagree". In addition, two questions pertained to orofacial injury rate from August 1998 to August 1999 and mouth guard use at the time of injury.

Procedure

Athletic trainers were mailed a survey packet including a cover letter, two-page MGKS, and addressed stamped return envelope. The cover letter outlined the purpose of the study, instructions for completing the survey, and confidentiality issues. The return envelopes were coded to identify respondents while maintaining confidentiality and anonymity. Upon completion, subjects were asked to return the questionnaire to the researcher in the stamped envelope provided. Survey completion took approximately 10 minutes. A reminder post card was mailed two weeks after the initial survey. Completed and collected surveys were kept in a locked file cabinet accessible only to the primary researcher.

Data Collection and Analysis

Data were collected in order to assess knowledge and attitudes towards mouth guards and the incidence of orofacial injury related with mouth guard compliance. Data were analyzed using the Statistical Package for Social Sciences (SPSS) software.

Descriptive statistics including means, medians, modes, frequency tables, and cross tabulations were used to analyze ATC knowledge, demographic information, and injury rates. A factor analysis was calculated to determine underlying factors and to determine if the questions were cohesive.

Results

Three hundred and seventy-four certified athletic trainers in California were surveyed in this study. Fifty-two percent ($n=193$) of the surveys were returned and 46% ($n=172$) were usable. Fifty-eight percent ($n=92$) of the respondents were male and 42.1% ($n=67$) respondents were female. More than half of the respondents worked in the collegiate setting, with 35.3% ($n=57$) in Division I, II, and III, and 25.3% ($n=41$) in the Junior college setting. Thirty-two percent ($n=51$) were employed in the high school setting, and the professional setting accounted for 8% ($n=13$) of the respondents. The majority of the respondents, 67.9% ($n=110$) were head athletic trainers, 21.6% ($n=35$) were assistant athletic trainers, 3% ($n=5$) part-time athletic trainers, and 7.4% ($n=12$) were Graduate Assistants. Years as a certified athletic trainer ranged from 1 to 30 with a mean of 10.5 years ($SD=6.7$ years). Association with a team dentist existed for approximately half (47%, $n=59$) of the athletic trainer institutions surveyed, (Table 1).

Mouth Guard Knowledge and Opinion Across Factors

Mouth guard knowledge and opinions were factor analyzed and collapsed to determine salient factors. The 25 mouth guard knowledge and opinion questions fell into eight components (Factors), accounting for 67% of the variance. Factors one (responsibility of mouth guard compliance) and two (athlete mouth guard perception) had a reliability of $r = .80$ and $r = .82$, respectively, accounting for approximately 40% of the variance (Table 2). The remaining factors (knowledge of effectiveness, perceived need for mouth guard regulation, actual mouth guard usage, barriers to mouth guard use, institutional practice, and mouth guard efficacy) were not cohesive with a reliability of $r = .5$ and below. Thus, these factors were subsequently discarded. Responsibility for mouth guard compliance (Factor 1) included five variables, responsibility of the certified athletic trainer, athlete, coach, officials, and the athlete's parents. Athlete Perception (Factor 2) included the variables, mouth guards don't work, athlete can't talk, mouth guards are too bulky, and restrict breathing.

Knowledge and Opinion of Mouth Guards

The majority of ATCs had a good working knowledge of mouth guard use, risks, compliance, and type. Almost all ATCs, 98% ($n = 169$), reported that mouth guards worn correctly, reduced the incidence of orofacial injury. In addition, the majority of ATCs, 97.6% ($n = 166$) indicated that mouth guards reduce the risk of concussion. A majority of ATCs, 77% ($n = 130$) identified mouth guards as an important piece of protective equipment and 60% ($n = 102$) agreed that mouth guards should be required in other

contact sports such as basketball and wrestling. Only one (0.6%) athletic trainer strongly disagreed that mouth guards should be worn in contact sports. Eighty-four percent (n= 143) agreed that athletes feel they can't talk when mouth guards are in place, mouth guards can be too bulky 84.2% (n= 144), and that athletes feel mouth guards restrict breathing 70.7% (n= 111).

Mouth Guard Compliance and ATC Practice

Responses related to mouth guard compliance indicate that the majority of ATCs do not attribute mouth guard use or compliance to any one faction of the athletic team (coaches, athletes, parents, officials, or ATCs). Seven percent of ATCs (n= 12) responded that the ATC is solely responsible for mouth guard compliance, 22% (n= 37) indicated that the athlete is solely responsible for mouth guard use, and 22% (n= 38) identified coaches as responsible. Similarly, 27% (n= 44) of ATCs believe that officials, and parents 11% (n= 18), are solely responsible for mouth guard compliance as well (Table 3).

Although there is little agreement on who is responsible for information dissemination to the athletes on mouth guard use, half of the ATCs, 52% (n= 88) indicated that they do inform athletes about mouth guards prior to the first practice. Eighty-seven percent (n= 149) advocate the use of mouth guards among their athletes compared to 12.9% (n= 22) who do not advocate mouth guard use among their athletes. Eighty percent (n= 135) of ATCs have been trained to deal with the emergency treatment of orofacial injuries on site.

Frequency of Orofacial Injury and Concussions

The large number of reported orofacial and head injuries incurred during August 1998 to August 1999 indicate that there is a need to reduce or control their occurrence. Sixty percent (n= 103) of athletic trainers reported 1-5 orofacial injuries and 22.1% (n= 38) subjects reported 6-10 orofacial injuries during August 1998 to August 1999. Overall, 76% of the ATCs reported concussion injuries with 44% of subjects reporting 1-5 concussions and 32% (n= 54) reporting 6-10 concussions. Mouth guard use at the time of injury was variable; however, only a small percentage of athletes injured (8%, n= 13) wore the protective equipment 100% of the time. Athletes who were not wearing mouth guards incurred the majority of injuries (26%, n= 43), while 22% (n= 36) of the athletes were wearing mouth guards 50% of the time when the injuries occurred above. In 30% (n= 50) of the cases above, the athlete was wearing a mouth guard most (75%) of the time.

Cross Tabulations

To determine ATC opinions and practices cross tabulations were calculated on the data to compare answers across questions. To assess ATCs opinion about mouth guards and whether or not athletes wear mouth guards and their institution, question 7 (proper mouth guard use can protect against orofacial and soft-tissue injuries) and question 23 (mouth guard usage at time of injury) were cross tabulated. Thirty-one (19%) ATCs reported that mouth guards can protect against orofacial injuries but when athletes at their institution sustained injuries to the head and orofacial structures the majority of athletes were not wearing mouth guards. Nine (6%) of the ATCs believe that mouth guards

protect against injuries where their athletes wear mouth guards consistently (100% of the time).

In order to assess ATC opinion on mouth guards and whether or not this information reaches the athletes, question 1 (mouth guards reduce the risk of orofacial injury) and question 8 (do you inform your players about the purposes and benefits of mouth guards before their first practice) were cross tabulated. More than half, (52%, n= 88) answered yes to both questions suggesting that ATCs believe mouth guards prevent injuries and inform their athletes of this before practice; whereas, 46% (n= 78) of ATCs who understand that mouth guards protect against injury do not dispense mouth guard information to their athletes prior to their first practice. Accordingly, when question 9 (do you advocate mouth guard use among your athletes) was cross tabulated with question 8 (informing players prior to first practice), half of the ATCs (50%, n= 85) answered yes to both questions, indicating that mouth guard information is disseminated prior to the first practice. Thirty-seven percent (n= 63) advocate mouth guard use but do not inform players about the purposes and benefits prior to the first practice. Eleven percent (n= 18) do not advocate their use or inform their players. Again, 48% of athletes, almost half, do not receive information on mouth guard benefits prior to the first practice from the athletic trainer.

Question 9 (advocate use) was cross tabulated with primary sports responsibility. Of the twenty-two ATCs that reported that they do not advocate mouth guard use, seven primarily worked with baseball, six with women's soccer, five with football, and two

with women's volleyball. Three out of the four sports listed do not require mouth guards to participate.

Question 1 (mouth guards reduce the risk of orofacial injury) was cross tabulated with question 23 (mouth guard usage at time of injury) to determine injury rate with and without a mouth guard in place. Forty-one (25%) of ATCs believe that mouth guards reduce the risk of injury, however when orofacial or concussive injuries occurred, only 13 (8%) were consistent mouth guard users 100% of the time.

Discussion

Fifty-two percent (n= 193) of the ATCs responded to the survey, indicating a moderate response rate which may have skewed the data, making generalizability difficult. Surveys were mailed during January, typically a hectic time for athletic trainers, which may account for the rate of return. The lack of interest in mouth guards or survey response may also be due to an athletic season where the sports of basketball, baseball, wrestling, and swimming primarily do not require mouth guards, or may indicate the overall attitude of ATCs toward the importance of mouth guards.

Research on responsibility for mouth guard information dissemination is sparse. Past research has identified the ATC as partially responsible for mouth guard compliance.⁸⁻¹¹ Results from current research seem to agree with past findings that compliance does not weight heavily on any one group.^{7,8,11} A pattern for both past research and the current study suggests that no one faction from the athletic arena (coaches, parents, athletes, officials, athletic trainers) accepts full responsibility for the promotion of mouth guard use and compliance. A range of 85-98% of correctly

answered questions on the knowledge portions of the MGKS indicated that athletic trainers are knowledgeable regarding mouth guard use, decreases in head and orofacial injury rate when mouth guards are used, and mouth guards types and benefits; however, ATCs are disseminating mouth guard information prior to the first practice, to only half of the athletes. A study surveying coaches on mouth guards found that athletic trainers were responsible for determining the type of mouth guard the team should be using. The coaches also indicated the athletic trainer as having the greatest influence on player compliance 14% of the time.¹¹ Yet results from this study indicate poor ATC involvement in mouth guard compliance where only 7% of ATCs believe it is their responsibility. The current study and past studies thus indicate a disparity resulting in less than optimal health care.

The prevention of athletic injuries is one of the 5 domains of athletic training practice. This domain includes information dissemination and equipment use that may potentially prevent injuries; thus suggesting that ATCs are responsible for mouth guard use and compliance. Although it may be the responsibility of the ATC to ensure the dissemination of mouth guard information, responsibility for prevention of injuries doesn't necessarily imply that athletic trainers take sole responsibility for information dissemination and compliance. A plan of action can be created by the ATC where the coaches, athletes, and parents are instrumental in mouth guard use and compliance. Currently, athletic trainers believe that mouth guards protect against injury, but only 52% inform athletes of the purposes and benefits of mouth guards before their first practice. This may be due to time constraints and work overload, again suggesting the need for a

plan of action where all individuals involved in the athletic arena partake in a plan to disseminate mouth guard information and maintain compliance.

The primary sports responsibility of the ATC may be another reason why half of the ATCs do not advocate mouth guards. ATCs who did not advocate mouth guard use worked primarily with sports that do not require mouth guards like baseball, women's soccer, and volleyball. Typically, athletes and athletic trainers are less likely to support and advocate mouth guard use in sports that do not require mouth guards for participation. However, the American Dental Association recommends mouth guards be worn in all sports where contact with an object or person may illicit injury. Thus, the athletic training prevention domain, coupled with knowledge that mouth guards should be worn in all sports reiterate the notion that ATCs should be responsible in creating a plan of action for mouth guard compliance.

One of the domains of the certified athletic trainer is health care administration in which athletic trainers should use a referral system specific to the setting by involving appropriate health care professional to facilitate proper care. This means that ATCs should refer athletes with orofacial injuries to a dentist for immediate treatment as part of the health care system. However, more than half of the ATCs in this study did not have a dentist affiliated with their institution. This may be an issue that needs to be better outlined in the NATA domains so that athletes receive optimal health care.

The lack of information disseminated to athletes may be one reason for the number of orofacial injuries and concussions occurring without the use of mouth guards in place, which may have been preventable according to current research.^{1-2, 5,6} During

the '98-'99 academic year, between 103 and 515 orofacial injuries were incurred.

Athletes wore mouth guards only 7.8% of the time raising speculation as to how many orofacial and/or head injuries could have been avoided had proper attention to mouth guards use been employed.

Conclusion

This research suggests that athletic trainers have a large amount of knowledge regarding mouth guards, yet the information is not reaching the athletes. This may account for non-compliance and may help explain the high incidence of orofacial and head injuries. Although the ATCs in this study believe that they are not solely responsible for mouth guard compliance, it can be argued that since ATCs are responsible for educating athletes and preventing injuries, they should also be responsible for advocating mouth guards as a preventative means to reduce orofacial injuries. Therefore, the ATC should consider implementing a system for mouth guard compliance at their institution.

Recommendation For Future Research

Research on athletic trainers and their role in mouth guard promotion is beginning to emerge. Clearly, research needs to be conducted on a larger sample across the country for generalizability. Further study may investigate injury rate with and without a mouth guard in place, systematically to obtain more precise injury data. Although this research investigated injury occurrence during one academic year, the data was collected retrospectively. Future studies should aim to collect data concurrently with injury occurrence to better represent mouth guard compliance and injury rate.

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Table 1. Demographic Information

Respondents	Frequency	Percent
Gender (N=159)*		
Male	92	57.9
Female	67	42.1
Setting (N=162)*		
College	57	35.3
Junior College	41	25.3
High School	51	31.5
Professional	13	8
Title (N=162)*		
Head ATC	110	67.9
Assistant ATC	35	21.6
Part-Time ATC	5	3
Other	12	7.4
Years ATC (N= 169)*		
1-5	40	23.7
6-10	63	37.2
11-15	30	17.8
16-20	23	13.6
21-30	13	7.6
Team Dentist (N=126)*		
Yes	59	46.8
No	67	53.2

*Missing data where ATC did not report demographic information

Table 2. Collapsed Factors

Mouth Guard Factors	Responsibility (Factor 1)	Athlete's Perception (Factor 2)
FACTOR 1- Responsibility		
Coach	.910	1.437E-02
Officials	.817	-.101
Athlete	.815	-.142
Athlete's Parents	.770	.106
ATC	.615	
FACTOR 2- Athlete's Perception		
Too Bulky	-8.968E-02	.892
Restrict Breathing	8.063E-03	.880
Can't Talk	-.122	.815
Mouth Guards Don't Work	.136	.713

Table 3. Mouth Guard Responsibility

Responsible Faction	N	Percent (%)
ATC Solely Responsible	12	10
Athlete Solely Responsible	37	22
Coaches Solely Responsible	38	22
Officials Solely Responsible	44	27
Parents Solely Responsible	18	11

Expanded Support Material

Project Proposal

Chapter I

INTRODUCTION

Between 2,000,000 and 5,000,000 teeth are dislodged each year, one third of which are estimated to occur during sports activities (Dental Injury Fact Sheet, 1992; Krasner, 1989; Nowjack-Raymer & Gift, 1996). One-quarter of the United States population has had at least one traumatized permanent tooth in a dental trauma (Kaste, Gift, Bhat, & Swango, 1996). Emergency dental procedures each year are estimated to cost \$500,000,000 (Krasner, 1989).

Research has been aimed at injury prevention due to the high numbers of injury to orofacial structures incurred yearly. Literature indicates that the mouth guard is highly effective at providing protection against face, head, and neck injuries (Chalmers, 1998). Properly fitted mouth guards can significantly reduce the incidence of orofacial injuries in contact sports (Chapman, 1983). Of equal or perhaps greater importance, mouth guards have been shown to reduce the likelihood of concussion by reducing the force transmitted to the base of the brain followed by an impact to the mandible (Hickey, Morris, Carlson, & Seward, 1967). Experts believe that to reduce dental and head injury rates, mouth guards are the most important piece of protective equipment for athletes (Seals, Morrow, Kuebker, & Farney, 1985).

Professionals indicate mouth guards and the protection they provide to the teeth, gums, jaw, and head are imperative in contact sports as well as other organized sports where the incidence of orofacial injury is high (Garon, Merkle, & Wright, 1986). Athletes, however, have not acknowledged the importance of mouth guards as seen by a

high orofacial injury rates and a low level of mouth guard usage among children, adolescents, college athletes, and professional athletes (Chapman, 1989; McNutt, Shannon, Wright, & Feinstein, 1989; Ranalli & Lancaster, 1995; Soporowski, Tesini, & Weiss, 1994). In addition, coaches report that regular mouth guard use is uncommon among athletes (Berg, Berkey, Tang, Altman, & Londeree, 1998).

Whose responsibility is it to provide mouth guard information to athletes? More specifically, who is responsible for athlete compliance and mouth guard use? Several studies have suggested that responsibility lies mainly with the head coach (Diab & Mourino, 1997; Ranalli & Lancaster, 1993; Ranalli & Lancaster, 1995); however, the athletic trainer has been repeatedly cited in research as responsible for the use of mouth guards (Seals, et al., 1985; Ranalli & Lancaster, 1995).

Current literature suggests that the athletic trainer is responsible for mouth guard compliance, thus there exists a need to study athletic trainers and their knowledge of mouth guards, as it pertains to athlete usage and injury rates. The duties of the athletic trainer includes knowledge in five domains of health care: 1) prevention of athletic injuries, 2) recognition, evaluation, and immediate care of athletic injuries, 3) rehabilitation and reconditioning of athletic injuries, 4) health care administration, and 5) education and counseling. The use of mouth guards are advocated as preventative medicine and fall under four of the five athletic training domains. Mouth guards are preventative against orofacial injuries, they are integral in the care and rehabilitation of concussion injuries, and should be recommended through education and counseling; however, if athletic trainers lack knowledge regarding mouth guards, it may impact their

ability to suggest mouth guards for the prevention of injuries. If responsibility partly lies on the athletic trainer to provide information about mouth guards and advocate their use, then it is important that they have a sound knowledge base about the efficacy and use of mouth guards. Research, however, has indicated that athletic trainers are not knowledgeable about the differences among the three types of mouth guards (Seals, et al., 1985). Thus, this lack of knowledge could be potentially hazardous to the athlete and may lead to misinformation about mouth guards and their effectiveness unsaid.

The use of mouth guards fall under four of the five domains of the athletic trainer. Therefore, the purpose of this study will be to determine athletic trainers' knowledge about injury prevention through mouth guard usage, and how this relates to orofacial injury rates.

Statement of the Purpose

The purpose of this project is to assess the knowledge and attitudes of certified athletic trainers towards mouth guards related to orofacial injury rate. This research will be compiled into a journal article and submitted to the Journal of Athletic Training.

Limitations

The project will be limited to the following factors:

1. Return rate of surveys. Mail questionnaires may be returned by individuals with an interest in mouth guards or considerably more knowledgeable on the subject, thus skewing results.
2. Time to complete the survey thoroughly. The surveys will be mailed in January, a busy time for sporting events. Certified athletic trainers may not possess

adequate time away from the job to devote time in completing the survey to the best of their knowledge and honestly.

3. The certified athletic trainer will be able to recall the number of orofacial and head injuries incurred at their institution in a specific year.

Delimitations

The study will be delimited to:

1. Certified athletic trainers in the state of California who are members of the California Athletic Trainers Association (CATA).
2. Certified athletic trainers who are employed in a high school, college, or professional setting. Certified athletic trainers working in clinics or employed elsewhere will not be included in this study.

Assumptions

The following factors will be assumed by the researcher:

1. Length of time that each subject has been certified by the National Athletic Trainers Association Board of Certification. The longer a subject has been certified, the broader knowledge base the athletic trainer has to draw from. The certified athletic trainer will answer each question honestly and to the best of their ability.
2. All certified athletic trainers involved in this study have at least a minimal knowledge about mouth guards.
3. Each participant will be able to follow written directions from the researcher and answer all questions with completely.

Definitions

- Athlete:** An individual participating in sport, either competitively or recreationally.
- Catastrophic Injury:** A permanent head or spinal cord injury.
- Certified Athletic Trainer:** A highly educated and skilled professional specializing in athletic health care, who has passed the National Athletic Trainers Association Board of Certification (NATABOC) examination. In cooperation with physicians and other allied health personnel, the athletic trainer functions as an integral member of the athletic health care team in secondary school, colleges and universities, sports medicine clinics, professional sports programs and other athletic health care settings (National Athletic Trainers Association On-Line, 1999).
- College Setting:** The place of employment for the certified athletic trainer that works at the Junior College or four year college/university level.
- Concussion:** An alteration of consciousness, disturbance in vision and equilibrium caused by a direct blow to the head, rapid acceleration and or deceleration of the head, or direct blow to the base of the skull from a vertical impact to the chin (Sports Dentistry On-Line, 1999).

- High School Setting:** The place of employment for the certified athletic trainer working with athletes in grades 9-12.
- Orofacial Injury:** Any injury including dental and dentoalveolar injuries, intraoral and circumoral lacerations, and fractures of the jaws (Chapman, 1989).
- Professional Sport Setting:** In this study, any professional sports organization where certified athletic trainers are employed.
- Major Injury:** Any injury that requires immediate medical attention.
- Mouth Guard:** A resilient device or appliance which is placed inside the mouth to protect against injuries to the teeth, lacerations to the mouth and fractures and dislocation of the jaw (Chalmers, 1998). For the purpose of this study mouth protector will be used interchangeably with mouth guard.
- Mouth Guard Use:** Any subject wearing one of the three types of mouth guards during practice or competition.

Chapter II

REVIEW OF LITERATURE

The purpose of this project is to assess the knowledge and attitudes of certified athletic trainers towards mouth guards as it relates to orofacial injury rates. Mouth guards provide injury protection to the teeth and gums when worn during athletic participation. Mouth guards have been shown to protect teeth, as well as, the head and neck from both major and catastrophic injuries (Stenger, Lawson, & Wright, 1964). Since mouth guard use has such widely reported benefits, why aren't mouth guards used beyond contact sports?

Currently, mouth guards are required equipment in the amateur sports of boxing, football, ice hockey, and women's field hockey; use in any other sport is purely voluntary (Ranalli & Lancaster, 1993). Krasner (1989) suggests that the lack of mandatory mouth guards may be the reason why there is such a high incidence of dental injuries each year. This chapter will be divided into four sections: 1) historical implications of mouth guards, 2) types of mouth guards and 3) injury rates associated with mouth guard use or disuse and 4) knowledge and attitudes towards mouth guards.

Historical Implications

The benefit of mouth guard use has been reported since 1913 with the initiation of their use in boxing events (Chapman, 1983). The original mouth guard was designed of curved trays that housed a rubber material. In order to keep the device in place, the boxer had to clench down on the trays with his teeth, which decreased air flow through the mouth and created a high risk of mouth guard displacement after a blow. Beginning

in the 1900s, mouth guards were identified as beneficial in orofacial protection and the reduction in unconscious episodes following repeated blows to the mandible (Jennings, 1990). Despite the identified benefits of mouth guards in boxing, little consideration was given to protection that they offer against injuries until decades later when more research began to surface about mouth guards (Jennings, 1990). When mouth guards were worn, there was a reduction in injuries to the teeth, lips and cheeks, jaw fractures, and concussions (Jennings, 1990). Currently, boxing is the only professional sport in which mouth guards are mandatory (Ranalli & Lancaster, 1993).

Research on the construction and optimal materials of mouth guards was conducted from 1950-1965. Research in this area suggests that mouth guards should be worn on the upper maxillary teeth since the upper teeth are the most prone to injury (Scott, Burke, & Watts, 1994). Cohen and Bousch (1958) found that oral injuries were eliminated in high school football players who were wearing properly fitted mouth guards. From these findings and a report from the Joint Committee on Mouth Protectors of the American Association of Health, Physical Education, and Recreation and the American Dental Association (1962), legislation was established making mouth guards mandatory for all football players at the high school and junior college level.

Stenger et al. (1964) researched mouth guards and injury rates and found that mouth guards protect against head injuries. In 1964, injury data was recorded through an entire season after the entire 1963 Notre Dame football team was fitted with mouth guards. Injuries to the teeth were reduced compared to the previous years, and the oral injuries incurred were due to the absence of mouth guards at the time of injury.

Concussions also decreased significantly for the season and in only one case of concussion was the injured athlete wearing a mouth guard. The reduction in neck injuries from wearing mouth guards was an unexpected result from this study. Stenger et al. concluded that due to the fit of the custom mouth guard, an altered mandible position causes the whole cervical vertebral column to move to a more posterior position, facilitating a better relationship between the articular facets, thus reducing neck injuries. Thus, by repositioning the jaw, with a mouth guard in place, the spinal column is put into a neutral position which is a more stable position in preparation for contact sports and injuries are reduced.

Hickey et al. (1967) also researched mouth guards related to head injuries. Intracranial pressure and bone deformation were studied on a cadaver, with and without a mouth protector, to determine if mouth protectors could reduce the forces transmitted to the brain. Two custom mouth protectors were made from an impression of the cadaver's upper dental arch. One was made of vinyl and the other of latex. Results from this study suggested that when a mouth protector was in place, there was a marked reduction in intracranial pressure, as well as, a reduction in jaw deformation. There was no significant difference in intracranial pressure and bone deformation between types of custom made mouth protectors; therefore, the authors concluded that either mouth protector aids in the reduction and severity of traumatic injuries to the jaw and head.

Implications from the Stenger et al. (1964) and Hickey et al. (1967) studies, have lead to current mouth guard legislation for collegiate athletics. In 1973 the National Collegiate Athletic Association (NCAA) was tentative regarding the adoption of

mandatory mouth guard rules in contact sports, citing that performance and speech might be detrimentally affected by forcing athletes to wear mouth guards (Johnsen & Winters, 1991); however, in 1974 after properly fitted mouth guards were found to not affect speech or performance, the mandatory mouth guard rule was passed (Johnsen & Winters, 1991).

Custom mouth guards are consistently cited in the reduction of serious injuries to orofacial structures and in the incidence of concussions (Hickey, et al., 1967; Johnsen & Winters, 1991; Stenger, et al., 1964). Thus type and effectiveness of the mouth guard should also be examined.

Types of Mouth Guards

The function of mouth guards is to protect against face, head, and teeth injury. Mouth guard protection to the teeth and gums by is afforded by preventing lacerations and soft tissue damage (Nicholas, 1969). In addition, mouth guards can help reduce the incidence of concussion from an upward blow to the mandible. This protection is accomplished by increasing the space between the condyles of the mandible to the base of the skull so the forces are not transmitted to the brain (Stenger, et al., 1964) (see Figure 1). Notably, experimental research about the effectiveness of mouth guards, has involved only custom made (Type III) mouth guards as opposed to stock (Type I) and boil and bite (Type II) mouth guards (Chalmers, 1998).

In addition to protective qualities, mouth guards should have certain standard qualities including comfort, unrestricted breathing and speech, retention, and proper intermaxillary positioning (Kerr, 1986). There are presently three types of mouth guards

available to the athlete with these standards. The American Society for Testing and Materials has classified mouth guards into three categories: Type I - stock, Type II - "boil and bite," and Type III - custom-fabricated by a dentist or trained professional.

Figure 1. Position of Mandibular Condyles With Out Mouth Guard and With Mouth Guard

Type I mouth guards or stock mouth guards are the most inexpensive of the three types. Stock mouth guards come ready made and do not require fitting (Chalmers, 1998) (see Figure 2). The only alterations that can be made to this device is trimming the upper edge that touches the vestibular mucosa to reduce rubbing (DeYoung, Robinson, & Godwin, 1994). Stock mouth guards cost as little as one dollar each (Duda, 1987) and are placed over the upper teeth of the athlete and held in place by clenching the teeth together (Chaconas, Caputo, & Bakke, 1985). These mouth guards provide low levels of protection to the teeth and oral structures and offer little retention over time; thus the replacement rate is more frequent compared to Type III custom fit mouth guards (Scott, et al., 1994). The stock mouth guard is designed to cover the entire row of upper teeth, making the physical structure of the mouth guard acceptable; however, the Type I

mouth guards have a poor fit and bulkiness that in general do not meet the minimum standards of comfort, retention, enabling speech, unrestricted breathing, and proper intermaxillary positioning (Kerr, 1986). For these reasons, Chapman and Nasser (1993) have suggested that this form of mouth guard should never be recommended to athletes by health professionals.

Figure 2. Stock Mouth Guard

Type II mouth guards, described as “boil and bite” or mouth-formed mouth guards, can be purchased through sporting goods stores and are inexpensive (one dollar) (see Figure 3). The boil and bite mouth guard is composed of two layers: a pre-formed outer layer and an inner liner made out of silicone rubber or acrylic gel (Chalmers, 1998). The boil and bite mouth guard is placed in boiling water for 10 to 45 seconds, immersed in cold water for a second, and then placed in the mouth of the athlete and adapted to the teeth (Kerr, 1986). To assist in keeping these mouth guards in place, straps are often attached to the device which attach to accompanying headgear (Duda, 1987).

Kuebker, Morrow, and Cohen (1986) studied mouth-formed mouth guards

(Type III) to determine if this type met the NCAA rules that specify mouth guards must cover all upper jaw teeth. Dental impression arch length on the maxillary casts were measured on football players from two universities. Twelve different models of mouth-formed mouth guards were obtained and measured.

Figure 3. Boil and Bite Mouth Guard

Results of the study suggest that the mouth-formed mouth guards used were too small to fit the majority (85%) of university football players. The largest mouth guard examined met the NCAA requirement in only 14.3% of the players. Single size mouth guards were determined to be inadequate for most football teams.

DeYoung and colleagues (1994) investigated the comfort and wearability of mouth-formed mouth guards compared to custom mouth guards. Forty-three percent of the participants reported that the mouth-formed mouth guards were loose in fit. Other complaints of bulkiness, speech problems, and difficulty breathing were also noted (DeYoung, et al., 1994). Thus, the minimum requirements of comfort, enabling speech, and unrestricted breathing were not met, making the mouth guard less effective.

Type III custom-fabricated mouth guards are made by a dentist or trained professional from an upper teeth mold (see Figure 4). The fabrication of the mouth guard is divided into four basic steps (Chalmers, 1998; Kerr, 1986): 1) impression of the maxillary teeth; 2) pouring the model; 3) thermoplastic material is formed on the model; and 4) mouth guard is trimmed and fitted to the athlete's mouth. This type of mouth guard is the most comfortable to the athlete, but also the most expensive from \$30- \$80 each (DeYoung, et al., 1994; Duda, 1987; Seals, et al., 1985).

Figure 4. Custom Mouth Guard

Comfort, protection and minimal interference with speech are important factors with mouth guards (Morrow, Kuebker, Golden, Walters, & Day, 1984). High school and university quarterbacks were studied, where minimal interference of the mouth guard is imperative, for speech intelligibility, and player preference. Two type II mouth guards were compared with three type III mouth guards. Each quarterback was measured for speech intelligibility with and without the mouth guard in place. Results of the study indicate that custom mouth guards interfered less with speech (20% fewer speech errors) than the mouth-formed mouth guard. All subjects indicated that the custom mouth

guards felt better, were more comfortable, and allowed for better speech as compared to the other forms of mouth guards (Morrow, et al., 1984).

A study regarding the comfort and wearability of mouth guards, indicated athlete preference for the custom mouth guard when a choice was given (DeYoung, et al., 1994). Athletes also reported no complaints regarding looseness of fit and little irritation while wearing the custom mouth guard. There is a general consensus that custom mouth guards are superior types of mouth guards (Kerr, 1986; Powers, 1982). Chapman and Nasser (1993) suggest that Type I and II mouth guards provide inadequate protection of the maxillary bone and have insufficient retention to prevent dislodgment. Similarly, it has been stated that drastic improvements should be made to Type I and Type II mouth guards, otherwise these mouth guards should not be promoted to athletes (Park, Shaull, Overton, Tucker, & Donly, 1994).

Although Type I and II mouth guards are actively discouraged in the literature, a majority of athletes are wearing these types of protection (Seals, et al., 1985). Athletic trainers should be able to distinguish between the various types of mouth guards and decide which type affords the greatest protection against injury. A question arises whether athletic trainers are able to make this distinction.

Injury Rates

Despite the benefits of mouth guards, children, adolescents, collegiate athletes, and professional athletes across the nation seldom wear them on playing fields (Diab & Mourino, 1997). Although one quarter of the United States population has had at least one traumatized permanent tooth, in the future numbers could be significantly reduced by

wearing a properly fitted mouth guards during athletic participation (Chapman, 1983; Kaste, et al., 1996).

Soporowski et al. (1994) conducted a two part study on injury rates and mouth guard use in children. Injury report forms were sent to various pediatric dentistry practices to obtain information on orofacial injuries in children. The children were also asked to complete a survey on mouth guard use. One hundred and fifty nine children suffering from orofacial injuries were seen in the various dental offices over a one year period. One hundred and fifty-six injuries were reported to the teeth and 100 (64.1%) of these injuries occurred while playing basketball, baseball, and hockey. In this study, baseball had the highest number of injuries at 34 (22%). In addition, the study discovered that out of 1,293 children surveyed, 862 played organized sports and 323 (37.5 %) experienced orofacial injuries, while only 48 (14.9%) were wearing mouth guards when injured. Two hundred and seventy five (85.1%) were not wearing mouth guards at the time of injury.

McNutt et al. (1989) studied adolescents and found that of 2470 interviews, 222 (9%) oral injuries were reported. One hundred and sixty seven (75%) of the oral injuries were sustained with no mouth guard in place. In addition, the rate of concussions when a mouth guard was not used was 36 out of 64 (56%) total concussions. The data indicated that a majority of the subjects were not wearing mouth guards (75%) when oral injuries occurred and more than half (56%) of the concussions reported occurred when mouth guards were not used. Due to the myriad of sports that can cause injury to the orofacial

structures and the head, the authors recommend that mouth guards be worn in such sports as baseball, basketball, rugby, lacrosse, karate, volleyball, and touch football.

In addition to adolescent mouth guard usage and injury rate, the incidence of orofacial injury at the high school level has been widely reviewed. Garon et al. (1986) conducted a survey of junior high and high school athletes. Seven hundred and fifty-four athletes surveyed experienced 93 (12%) orofacial injuries and 29 (4%) reported concussions. Sixty-three of the orofacial injuries and 14 of the concussions (63% total) occurred while athletes were not wearing mouth guards. The authors noted that more than half of orofacial injuries in athletes not wearing mouth guards were reported in sports other than football including baseball, basketball, and unorganized football. Again, mouth guards should be advocated in non-collision contact sports.

A study which examined orofacial injury rates in high school basketball players (n= 1020) found that a total of 633 orofacial injuries were sustained by 315 players during one season (Mastrello-DeMoya & Primosch, 1989). Forty-three (4.2 %) of the 1020 athletes participating in this study wore mouth guards. Two of these athletes sustained an orofacial injury while wearing the mouth guard, but no medical attention was needed for these athletes. Three hundred and thirteen injuries were reported in the 977 (32 %) who were not wearing mouth guards. This indicates a 6.8 fold increase in the number of reported injuries when the mouth guard were not worn. The authors suggest that mouth guards should be worn in organized basketball.

To determine orofacial injury rates with mouth guard use in high school age athletes, Flanders & Bhat (1995) conducted a study in the state of Illinois in conjunction

with the Illinois Association of Athletic Trainers. Athletic trainers at various high schools collected orofacial injury data on all sports. Among the 820 football players studied, only one sustained an orofacial injury. The athletic trainers reported that football players wore mouth guards at all times compared to basketball players who did not wear mouth guards at all times. The 120 basketball players studied sustained 14 reported orofacial injuries. The data indicated that 0.07% of the total injuries in football and 34% in basketball were attributed to orofacial injuries. This research suggests that when mouth guard use is mandatory, orofacial injury rates are low. In basketball, where mouth guard use is not required, orofacial injury rates account for one third of the total injuries. If athletic trainers are responsible for delivery of mouth guard use and knowledge to athletes, then they should understand the impact of their use in both collision and non-collision sports.

Knowledge and Attitudes Towards Mouth Guards

Research on knowledge and attitudes towards mouth guards has been collected from a variety of subject groups. Diab and Mourino (1997) were interested in parental attitudes towards mouth guards. Three hundred and fifty nine parents or guardians of athletes responded to a survey where 55.7 % of the respondents believed their child should be required to wear a mouth guard. Forty-one percent of the respondents believed that mouth guards should be mandatory in football, boxing, ice hockey, lacrosse, and field hockey; however, only 29 % (124/430) of the children who participated in a supervised sport wore a mouth guard. When given the option to chose who was responsible for enforcing mouth guard wear, the parents chose the coaches as primarily

responsible 271 times. When coaches were asked if they would encourage athletes to use mouth guards if they were provided for free, 159 (31.3 %) of the coaches said they would not encourage mouth guard use (Berg, et al., 1998). Research repeatedly suggests that coaches are primarily responsible for encouraging mouth guard compliance (Berg, et al., 1998; Diab & Mourino, 1997; Ranalli & Lancaster, 1993, 1995; Seals, et al., 1985).

Even though coaches have been repeatedly held primarily responsible for mouth guard use, it is the athlete who is ultimately responsible for mouth guard use. In a study by Seals et al. (1985), 25% of survey respondents believed that the athlete should be responsible for mouth guard use. Chapman (1985a, 1985b) has conducted several studies of rugby players to assess injury rates and player attitudes towards mouth guards. In a two part study, 4 out of 5 of players who sustain injuries to the orofacial structures were not wearing mouth guards at the time of injury. All players agreed that a custom mouth guard could reduce orofacial injuries, yet felt that mouth guards should not be made mandatory. Similar results were found by Chapman (1989) where 95% of the rugby players believed that mouth protectors provided local protection but only 50% wore them regularly. Athletes reported the main reason they reject mouth guards were from reported difficulties with breathing, speaking, and discomfort (Chapman, 1989).

Ranalli and Lancaster (1995), surveyed NCAA football coaches about mouth guard regulations and player compliance. The objective was to determine if coaches were primarily responsible for player compliance with mouth guards. Results from this inquiry suggest that the coaches felt the individuals responsible for determining the type of mouth guard the team should use was the athletic trainer. Fifty-six percent of the

respondents felt the athletic trainer was responsible, while 36% felt it was the athletic trainer and additional personnel. Coaches were asked who had the greatest influence on player compliance, and indicated themselves 26% of the time and the athletic trainer 14% of the time. In another study by Seals et al. (1985), the athletic trainer was held responsible 30 % of the time. This information suggests that athletic trainers should be knowledgeable about mouth guards and their protective qualities since they are recognized as influential with player mouth guard compliance.

The purpose of this project is to investigate certified athletic trainer's knowledge and attitudes towards mouth guards, and identify the corresponding orofacial injury rate as it relates to knowledge and attitude. The current body of research has yet to address the athletic trainer's opinion of mouth guards and their efficacy. Athletic trainers appear in the literature as having responsibility for mouth guard promotion, thus athletic trainers' knowledge of mouth guards and use should be investigated.

Summary

As early as the 1960s researchers have repeatedly demonstrated the importance of mouth guards in providing protection from orofacial and head injuries. Research indicates that custom fitted mouth guards provide protection to the head, face, and could reduce the force transmitted to the base of the skull (Hickey, et al., 1967; Stenger, et al., 1964). These studies along with others, have contributed to mandatory mouth guard regulations in the high school and collegiate setting that are still in use today.

The importance of mouth guard use to reduce injury is evident, accordingly interest in the different types of mouth guards on the market, as well as, interest in the

type best suited for athlete protection has increased. Although mouth guards can reduce oral injury (Seals, et al., 1985), the custom fitted mouth guards are superior in preventing injury to the orofacial structures and the head, and also interferes the least with speech, breathing, and are the most comfortable (Morrow, et al., 1984).

Mouth guards have been shown to protect and reduce the number of orofacial injuries from children participating in unorganized sport (Chapman, 1985a, 1985b; Sane, 1988; Soporowski, et al., 1994) to professional rugby players. Coaches perceive athletic trainers as having responsibility in the regulation of athlete mouth guard use. In addition, athletes have indicated an aversion to use mouth guards. If athletic trainers are to aid in the understanding of mouth guard use and compliance, then they should be knowledgeable in this area. To this date, there has been no identified research on the knowledge and attitudes of athletic trainers about mouth guards. Athletic trainers have not been surveyed on their understanding of the efficacy of mouth guards. The lack of data on the athletic trainer and mouth guard knowledge has revealed a need to answer these questions. Therefore, the purpose of the current study is to determine athletic trainers mouth guard knowledge regarding the efficacy of mouth guards and how this relates to injury rates.

Chapter III

METHOD

The purpose of this project was to assess the knowledge and attitudes of certified athletic trainers towards mouth guards and related to orofacial injury rates. This research was compiled into a journal article for the Journal of Athletic Training and submitted for publication. This chapter contains information on subjects, instrumentation, procedures, and analysis of data for the current study.

Subjects

Three hundred and seventy four athletic trainers in the state of California who are currently certified by the National Athletic Trainers Association (NATA) were surveyed for this study. Each subject was a member in good standing of the California Athletic Trainers Association (CATA) and employed in either a high school, college, or professional setting. A list of ATCs currently employed in the high school, collegiate, or professional setting was obtained from the CATA membership directory. The CATA membership directory is public information and available upon request; thus, all subjects were selected to participate in this study from this list.

Instrument Development

The questionnaire was intended to ascertain certified athletic trainers' (ATC) knowledge about and attitude towards the effectiveness or non-effectiveness of mouth guards. The researcher developed a survey based on current research and a similar survey on mouth guard knowledge (Koch, Moavenian, Parker, Watson, & Westfall, 1996).

A two page questionnaire was designed to test the ATCs knowledge of mouth-guards and to assess the number of orofacial and concussion injuries at their institution (see Appendix A). Specific questions were designed regarding knowledge of mouth guard effectiveness, perceived reasons why use is minimal, responsibility of mouth guard regulation, and actual mouth guard usage. A total of twenty-three questions were asked on the survey. Twelve questions were designed to ascertain athletic trainers' knowledge of mouth guards using Yes or No answers. Eleven questions were designed using a five point Likert scale to rate athletic trainers' opinion about various mouth guard topics; 1 corresponded with "strongly agree" and 5 corresponded with "strongly disagree". Two questions were designed to assess the frequency of orofacial injuries during the previous year throughout all sports. Subjects were asked to record the number of injuries in groups of five; (ie, 0, 1-5, 6-10, 11-15, 16+) per year in order to recall in general how many orofacial injuries were experienced. In addition, demographic information were collected regarding years of service, setting of employment, gender, if there was a team dentist affiliated with their institution, and primary sports responsibility.

A pilot study was conducted for content validity by professional ATCs and dentists knowledgeable in sports dentistry. Based on recommendations by experts, revisions were made to the questionnaire. A second pilot study was conducted to determine reliability with 15 graduate athletic training students at San Jose State University.

Procedures

Pilot Study

A pilot study was conducted with 20 California ATCs. ATCs were selected to participate in this pilot study based on proximity in the Bay Area. These subjects were subsequently removed from the respondent pool. Each of the subjects worked in either the high school, collegiate, or professional setting. Two dentists knowledgeable in sports dentistry were chosen to participate in the pilot study.

A survey packet including a cover letter, a one page survey, a supplemental questionnaire, and a stamped addressed envelope was sent to the twenty selected ATCs, (see Appendix B and C). The cover letter explained the purpose of the study and gave detailed instructions about completion of the survey and supplemental questionnaire. Completion of the survey was consent for participation and anonymity and confidentiality were maintained. The subjects were asked to answer each question completely and to the best of their knowledge. Once the questionnaire was complete, the subjects were asked to complete the supplemental questionnaire about the overall efficacy of the original survey. The supplemental questionnaire contained questions on perceived relevance of questions asked, content analysis, clarity of survey, opinions, and suggestions. Upon completion of the two questionnaires, the subjects were instructed to return both surveys within two weeks in the envelope provided.

All surveys were returned and quantitatively reviewed by the researcher and an expert in the field of athletic training to establish content validity. Descriptive statistics

were used for an item analysis of knowledge and injury rates. Modifications were made in accordance with the results of the supplemental questionnaire.

A second pilot study was conducted to establish reliability of the survey instrument. Fifteen graduate athletic trainers were chosen for the pilot study. The athletic trainers were given the survey on a Wednesday night before their class. The following week, the athletic trainers were given the exact same survey. Surveys were numbered to maintain anonymity and confidentiality. Reliability tests were not calculated because the design of the survey violated assumptions for statistical analysis.

Procedure

A Human Subjects review for the Protection of Human Subjects was approved by San Jose State University prior to beginning the study. A survey packet including cover letter, survey, and a stamped addressed return envelope was sent to 374 subjects at their place of employment. The cover letter outlined the purpose of the study and detailed instructions on completing the survey. The cover letter stated that consent to participate was assumed with completion and return of the survey. Subjects were encouraged to contact the researcher for any questions regarding the questionnaire or the study, (see Appendix D).

Upon completion, subjects were asked to return the questionnaire to the researcher in the addressed stamped envelope provided. Survey completion took approximately 10 minutes. A reminder post card was mailed two and a half weeks after the initial survey to all non-respondents. Completed and collected surveys were kept in a

locked file cabinet at the researcher's home. Only the primary researcher had access to the surveys.

Data Analysis

Descriptive statistics including means, medians, modes, and cross tabulations were used to analyze ATC knowledge questions and demographic information. Frequency distribution tables were used to determine the number of orofacial and concussion injuries. In addition, a factor analysis was used to determine any underlying factors and to analyze any cohesion between among survey questions. Data was entered into the computer using Statistical Package for Social Sciences (SPSS) software.

Project Completion

The current research project was compiled into a journal article to be submitted to the Journal of Athletic Training. The article was written in compliance with standard format and content as required by the Editorial Board for the Journal of Athletic Training (see Appendix E).

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APPENDIX A
QUESTIONNAIRE

APPENDIX A Questionnaire

Sex: Male Female Age: _____ Years as a Certified Athletic Trainer: _____

Do you currently have a dentist affiliated with your institution? Y N

Title: A) Head Athletic Trainer
 B) Assistant Athletic Trainer
 C) Part-Time Athletic Trainer
 D) Other: _____

Setting: A) Professional
 B) Division I College/ University
 C) Division II College/ University
 D) Division III College/ University
 E) Community College
 F) High School

Primary Sports Responsibility: _____

Circle Yes or No to questions 1-12:

1. Mouth guards, if worn correctly, reduce the incidence of orofacial injury.	Yes	No
2. Mouth guards reduce the risk of concussion.	Yes	No
3. A "boil and bite" mouth guard is just as effective as a custom fit mouth guard.	Yes	No
4. There is no difference between "boil and bite" mouth guards and custom mouth guards.	Yes	No
5. A properly fitted mouth guard is just as important as a helmet in preventing injuries to the face and head.	Yes	No
6. Mouth guards are currently required pieces of equipment in the amateur sports of football, field hockey and ice hockey.	Yes	No
7. Proper mouth guard use can protect against neck, orofacial, and soft-tissue injuries.	Yes	No
8. Do you inform your players about the purposes and benefits of mouth guard use before their first practice?	Yes	No
9. Do you advocate mouth guard use among your athletes?	Yes	No
10. Are there any barriers to mouth guard use at your institution?
If Yes, please list: _____	Yes	No
11. Have you been trained to deal with emergency treatment of orofacial injuries on site?	Yes	No
12. At the institution where you work:		
A) Athletes <u>generally</u> wear mouth guards as required in the sports of FB, hockey, and lacrosse.	Yes	No
B) Athletes <u>always</u> wear mouth guards as required in the sports of FB, hockey, and lacrosse.	Yes	No
C) In the sports that do not require mouth guards, athletes generally wear mouth guards.	Yes	No

Circle the number directly corresponding to your opinion about questions 13-23 :

- | | Strongly
Agree | | Somewhat
Agree | | Strongly
Disagree |
|--|-------------------|---|-------------------|---|----------------------|
| 13. Mouth guards should be required in other contact sports such as wrestling and basketball. | 1 | 2 | 3 | 4 | 5 |
| 14. Mouth guards should NOT be required in any sports besides those currently required to. | 1 | 2 | 3 | 4 | 5 |
| 15. Athletes feel that mouth guards don't work. | 1 | 2 | 3 | 4 | 5 |
| 16. Athletes feel they can't talk when mouth guards are in place. | 1 | 2 | 3 | 4 | 5 |
| 17. Athletes feel that mouth guards are too bulky (uncomfortable). | 1 | 2 | 3 | 4 | 5 |
| 18. Athletes feel that mouth guards restrict breathing. | 1 | 2 | 3 | 4 | 5 |
| 19. The certified athletic trainer is solely responsible for mouth guard compliance. | 1 | 2 | 3 | 4 | 5 |
| 20. The athlete is solely responsible for mouth guard use. | 1 | 2 | 3 | 4 | 5 |
| 21. The coach is solely responsible for enforcing mandatory mouth guard compliance. | 1 | 2 | 3 | 4 | 5 |
| 22. The officials are solely responsible for enforcing mandatory mouth guard regulations. | 1 | 2 | 3 | 4 | 5 |
| 23. The athlete's parents are solely responsible for mouth guard compliance. | 1 | 2 | 3 | 4 | 5 |
| 24. Frequency of Orofacial Injury and Concussions during the last academic year (orofacial injury- mouth, teeth, lips, gums, and jaw). Please indicate the number of injuries at your institution, from August 1998 to August 1999, by <u>circling</u> the corresponding ranges below. | | | | | |

Orofacial Injuries: 0 1-5 6-10 11-15 16+

Concussions: 0 1-5 6-10 11-15 16+

25. In general, when the injuries occurred above, were the athletes wearing mouth guards: (please circle)

- 1) 0% of the time
- 2) 25% of the time
- 3) 50% of the time
- 4) 75% of the time
- 5) 100% of the time

APPENDIX B
PILOT STUDY COVER LETTER

APPENDIX B Pilot Study Cover Letter

Dear Certified Athletic Trainer:

Injuries to the head and face are increasingly common in athletics. It has been estimated that as many as one-third of all dental injuries are sports related. Therefore, your participation in this pilot study on knowledge and attitudes towards mouth guards and orofacial injury incidence is important.

The attached survey has been developed to study these issues. Your contribution is an important part of this pilot study and will be greatly appreciated. This survey takes only 10 minutes to complete. Please fill out the attached mouth guard survey and supplemental survey to evaluate the questionnaires effectiveness.

Please note that all responses will be recorded anonymously and there are no risks to you through your participation. Completion and return of the survey serves as consent to participate in this study.

A stamped return envelope has been provided to mail both surveys back by November 15, 1999. Again, thank you for your time and your help in completing this survey.

Sincerely,

Meredith A. Dillon, A.T.,C.

APPENDIX C
SUPPLEMENTAL SURVEY

APPENDIX C Supplemental Survey

1. Information is easy to understand: Yes _____ No _____
2. Information is arranged in logical order: Yes _____ No _____
3. Directions are easy to follow: Yes _____ No _____
4. Terms are understandable: Yes _____ No _____
5. Language is clear and concise: Yes _____ No _____
6. Information is relevant to the athletic training setting: Yes _____ No _____

Comments/Suggestions:

APPENDIX D
PROJECT COVER LETTER

Appendix D Project Cover Letter

Dear Certified Athletic Trainer:

Injuries to the head and face are increasingly common in athletics. It has been estimated that as many as one-third of all dental injuries are sports related. Therefore, your participation in this pilot study on knowledge and attitudes towards mouth guards and orofacial injury incidence is important.

The attached survey has been developed to study these issues. Your contribution is an important part of this pilot study and will be greatly appreciated. This survey takes only a few minutes to complete. Please fill out the attached mouth guard survey and supplemental survey to evaluate the questionnaires effectiveness.

Please note that all responses will be recorded anonymously and there are no risks or benefits to you through your participation. Your voluntary completion and return of the survey serves as consent to participate in this study. Choosing not to participate in this study will have no affect on your relations with San Jose State University.

A stamped return envelope has been provided to mail both surveys back by February 20, 2000. If you have any questions about this study, I can be reached at (408) 378-4901. If you have questions or complaints about research subject's rights, please contact Leamor Kahanov, Ed.D, at (408) 924-3030, or Nabil Ibrahim, Ph.D., Associate Vice President for Graduate Studies and Research, at (408) 924-2480. Again, thank you for your time and your help in completing this survey.

Sincerely,

Meredith A. Dillon, A.T.,C.

APPENDIX E

AUTHORS NOTES FOR THE JOURNAL OF ATHLETIC TRAINING

Appendix E Authors Notes for the Journal of Athletic Training

(Revised January 1999)

The mission of the *Journal of Athletic Training* is to enhance communication among professionals interested in the quality of health care for the physically active through education and research in prevention, evaluation, management, and rehabilitation of injuries.

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4. Financial support or provision of supplies used in the study must be acknowledged. Grant or contract numbers should be included whenever possible. The complete name of the funding institution or agency should be given, along with the city and state in which it is located. If individual authors were the recipients of funds, their names should be listed parenthetically.
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13. Begin numbering the pages of your manuscript with the abstract page as #1; then, consecutively number all successive pages.
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15. Titles should be brief within descriptive limits (a 16-word maximum is recommended). If a disability in the relevant factor is an article, the name of the disability should be included in the title. If a technique is the principal reason for the report, it should be in the title. Often both should appear.
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2. Council on Scientific Affairs. Scientific issues in drug testing. *JAMA*. 1987;257:3110-3114.
- Books:
1. Fletcher DH, Jones RT. *Growing Old in America*. New York, NY: Oxford University Press Inc; 1977:210-216.
2. Spanner JT, Brown QC. Immunology of influenza. In: Kilbourne ED, Gray JH, eds. *The Influenza Virus and Influenza*. 3rd ed. Orlando, FL: Academic Press Inc; 1975:373-393.
- Presentations:
1. Stone JA. Swiss ball rehabilitation exercises. Presented at: 47th Annual Meeting and Clinical Symposium of the National Athletic Trainers' Association; June 12, 1996; Orlando, FL.
- Internet Sources:
1. Knight KL, Ingersoll CD. Structure of a scholarly manuscript: 66 tips for what goes where. Available at <http://www.nata.org/jat66tips.html>. Accessed January 1, 1999.
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