



## Dentists' attitudes towards mouthguard protection

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### Abstract

**Purpose:** This study analyzed the attitudes of Virginia general dentists, orthodontists, and pediatric dentists towards mouthguard protection.

**Methods:** Questionnaires were constructed and mailed to 2500 dentists in Virginia.

**Results:** In this survey, 97% of orthodontists, 84% of pediatric dentists, and 67% of general dentists recommended mouthguard protection for their athletically active patients. The two main reasons for not recommending mouthguards were that the patient could obtain one from a less expensive source than the dental office and the dentist had not received formal training on fabrication or use of mouthguards. More recent graduates were more likely to have been taught mouthguard use and fabrication during their dental training. General dentists (59%) and pediatric dentists (56%) recommended the custom mouthguard while orthodontists recommended the prefabricated stock type (77%) as their primary choice of mouthguard. A majority of general dentists (58%), orthodontists (81%), and pediatric dentists (76%) recommended mouthguard protection for the contact sport of basketball which presently is a non-mandated mouthguard sport.

**Conclusion:** Most dentists agree that athletically active patients require mouthguard protection. Many dentists, however, question whether they were the ones responsible for distributing and fabricating the mouthguards. (*Pediatr Dent* 21:340-346, 1999)

In the past 30 years, there have been numerous articles on the subject of mouthguard protection for individuals participating in a sporting activity. Many of these articles have focused on the attitudes of players, coaches, referees, and school and league officials towards mouthguard protection.<sup>1-9</sup> Presently, no articles exist on dentists attitudes towards mouthguard protection.

In 1960, the Report of the Joint Committee on Mouth Protectors of the American Association for Health, Physical Education, and Recreation, and the American Dental Association showed the importance of mouth protection in athletics.<sup>10</sup> This report was the foundation for the National Alliance Football Rules Committee (NAFRC) in 1962 to mandate mouthguard protection for its high school and collegiate football players. In 1973, the National Collegiate Athletic Association (NCAA), not a member of the NAFRC, also required mouthguard use for its football participants.<sup>11</sup> Since

then, organized dentistry has continued to be active in the prevention of oral and facial injuries during athletic endeavors, as evident with the formation of the Academy of Sports Dentistry in 1983.

Presently only the amateur sports of football, ice hockey, boxing, men's lacrosse, and women's field hockey and the professional sport of boxing mandate mouthguard protection.<sup>7</sup> The documented need for mandated mouthguard use has been shown for all players of contact sports.<sup>3-5,12-16</sup>

A study by Davis and Knott in 1984 determined that one-third of all dental trauma occurred in sporting accidents.<sup>17</sup> The high incidence of oral and head and neck trauma during sporting activities has been well documented with the literature showing that the incidence of hard and soft tissue injuries, jaw fractures, concussions, and neck injuries have been reduced with the use of mouthguard protection.<sup>3-5,12-22</sup> Mouthguards can prevent concussions and cerebral hemorrhage by preventing the condyles from being displaced upward and backward against the glenoid fossa, thereby reducing the severity of intercranial pressure and bone deformation.<sup>23-25</sup>

There are generally three types of mouth protectors: the stock, the mouthformed, and the custom made.<sup>26</sup> The stock mouthguard is made in several standard sizes, and it is held in the mouth by clenching the teeth together. The mouth formed or boil and bite mouthguard is molded to an individual's teeth after being softened in warm water. The custom made type is fabricated by making an impression of the maxillary arch for individuals with a class I or II occlusion and the mandibular arch for individuals with a class III occlusion. A stone model is poured, and a thermoplastic sheet is heated and vacuum formed to the cast. The mold is cut, adjusted, and polished for an individual fit.

The most desirable qualities of a mouthguard are protection, retention, comfort, fit, ease of speech, resistance to tear, and ease of breathing. These qualities are best obtained with the custom made mouthguard.<sup>26-30</sup> The custom made mouthguard can be made for any patient whereas the mouthformed cannot. Kuebker and colleagues reported that the mouth formed type of mouthguards available were not large enough to properly cover all posterior teeth in 85% of high school and college athletes tested.<sup>31</sup> The custom mouthguard provides the most protection and is used with the most compliance. The custom mouthguard is therefore the best type of

**Table 1. Dentists Receiving Instruction on Mouthguard Fabrication During Training**

Response	Dentists
Yes	381
No	595
No reply	16
<b>Total</b>	<b>992</b>

mouthguard one can recommend, but it can only be fabricated with the aid of a dentist. Dental Practice Acts for many states stipulate that anyone other than a dentist making an impression or modifying an appliance for an athlete may be in violation of these regulations.<sup>32</sup>

The dentist should be one of the main sources for obtaining information about mouthguards. Seals et al. reported that 72% of high schools reported using sales representatives as sources of information for selecting mouthguards, 33% reported using publications and literature, and only 11% consulted dentists.<sup>6</sup> A dentist's understanding of the oral cavity and knowledge of appliance fabrication makes them an excellent source for mouthguard information. The purpose of this study was to determine dentists' attitudes towards mouthguard protection.

## Methods

A thirteen question, one-page survey was sent to 2,500 dentists in Virginia. A survey analyst reviewed the questionnaire. The survey was field tested by distributing it to various faculty members at the Medical College of Virginia School of Dentistry of Virginia Commonwealth University. A final version of the survey was created from comments collected. The dentists were chosen randomly from a list of licensed dentists throughout the state. Only general dentists (2,199), orthodontists (213), and pediatric dentists (88) were surveyed. The general dentists were surveyed randomly from the list, thereby allowing general dentists from all regions of the state to be surveyed. The 2,500 surveys sent out represent 65% of all the dentists in the state, or 73% of all general dentists, and 100% of all orthodontists and pediatric dentists. These three groups of dentists were chosen because they usually see the same patients on a regular recall basis. Demographic information (sex, age, and number of years practicing dentistry) were elicited. Questions were asked about advocating, fabricating, and marketing of mouthguards as well as other intraoral appliances.

A stamped addressed envelope was enclosed for dentists' returned responses.

Participants were asked a yes/no question as to whether or not they routinely recommended mouthguards for their athletically active patients. Respondents that answered "yes" were directed to answer an additional two questions then continue, and respondents that answered "no" were directed to answer an additional question and continue. All responses were recorded even if more than one response was selected for an item that called for a single response. Comments were summarized and reported where appropriate.

Responses to the questionnaire were tabulated and percent frequency distributions for responses to each item computed. Percents for all items were based on the total number of respondents to the survey or to the three subgroups of general dentists, orthodontists, or pediatric dentists. Additionally, the data on various questions were cross-tabbed and a chi-square analysis was run to determine statistical significance. The value of  $P < 0.05$  was regarded as significant.

## Results

Of the 2,500 surveys sent out, 1,003 surveys were returned for an overall return rate of 40%. The response rate was 834 (38%) for general dentists, 113 (53%) for orthodontists, and 45 (51%) for pediatric dentists. A total of 11 surveys were eliminated. Five surveys were discarded because the dentists indicated that they were retired and no longer practicing dentistry. Four surveys were discarded because the practitioners indicated that they were either dental residents or specialists in an area other than an orthodontics or pediatric dentistry. One survey was eliminated because the dentist indicated he performed only administrative work and no clinical dentistry. One survey was eliminated because the practitioner indicated he was both an orthodontist and a pediatric dentist. The number of total usable surveys was 992.

Eight hundred and seventy three practitioners were male (88%), 116 (11%) were female, and 3 (<1%) did not specify a gender. Eighteen years was the mean number of years each dentist had been practicing with a range of 0.5 to 50 years. Eleven dentists did not respond to this question.

Practitioners were asked if they received instruction on mouthguard fabrication during their dental training. Tabulated responses are listed in Table 1. Responses were not subdivided for general dentists, orthodontists, and pediatric dentists because the survey question did not specify whether or not this training was received in dental school or during specialty training.

**Table 2. Mouthguard Fabrication During Dental Training vs. Number of Years in Practice\***

Response	0-10 years <i>N (%)</i>	11- 25 years <i>N (%)</i>	25 years <i>N (%)</i>
Yes	141 (57)	186 (37)	50 (22)
No	103 (41)	312 (62)	173 (76)
No reply	4 (2)	8 (1)	4 (2)
<b>Total</b>	<b>248 (100)</b>	<b>506 (100)</b>	<b>227 (100)</b>

\*Eleven practitioners did not indicate number of years in practice.

**Table 3. Practitioners That Routinely Recommend Mouthguards for Their Athletically Active Patients**

Response	General Dentists N (%)	Orthodontists N (%)	Pediatric Dentists N (%)	All Dentists N (%)
Yes	555 (66)	109 (97)	38 (85)	702 (71)
No	276 (33)	4 (3)	6 (13)	286 (28)
No reply	3 (1)	0 (0)	1 (2)	4 (1)
<b>Total</b>	<b>834 (100)</b>	<b>113 (100)</b>	<b>45 (100)</b>	<b>992 (100)</b>

Mouthguard fabrication during dental training was additionally analyzed by the number of years in practice (0-10 years, 11-25 years, and >25 years). The data for the number of years practicing was cross tabbed with the data on whether a practitioner was instructed on mouthguard use during his/her dental training. Tabulated responses and percentages for this cross-tabbed data are listed in Table 2. It should be noted that 11 dentists did not respond to the number of years in practice. A chi-square analysis on the number of years practicing versus whether one was instructed on mouthguard use during dental training was found to be statistically significant ( $P=0.0001$ ) for the cross-tabbed data.

Practitioners were asked if they routinely recommend mouthguards for their athletically active patients. Tabulated responses and percentages are listed in Table 3.

Whether or not a practitioner routinely recommended mouthguards for his/her athletically active patient was additionally analyzed by the number of years one had been practicing. An analysis of dentists practicing 0-10 years had 172 answering yes, 75 answering no, and one not replying. An analysis of dentists practicing 11-25 years had 360 answering yes, 144 answering no, and two not replying. An analysis of dentists practicing over 25 years had 163 answering yes, 63 answering no, and one not responding. It should be noted that eleven dentists did not respond to the number of years in practice. The data for the number of years practicing was cross-tabbed with the data on whether one routinely recommended mouthguards and a chi square analysis determined no statistical significance ( $P>0.05$ ).

Whether or not a practitioner routinely recommended mouthguards for his/her athletically active patient was additionally analyzed by gender. Mouthguards were recommended by 71% of male and 67% of female practitioners. A chi square analysis was performed on this cross tabbed data. Routine mouthguard recommendation and gender did not prove to be statistically significant ( $P>0.05$ ).

Each dentist was asked to check all sporting activities where they would recommend mouthguard use. Twenty-one sporting activities were listed (Table 4).

Only practitioners that routinely recommended mouthguard protection for their athletically active patients were directed to indicate what type of mouthguard they primarily advocated. These practitioners were asked to check either stock, mouthformed, or custom made. Some practitioners chose to pick more than one type, so each choice picked was tabulated (Table 5).

The 286 practitioners indicating they did not routinely advocate mouthguard protection for their athletically active

patients were additionally asked to choose various responses indicating why. Many practitioners chose more than one response, so each choice picked was tabulated (Table 6).

## Discussion

An oral injury may occur with anyone who participates in competitive sports or some recreational activities. The mouthguard is a proven source of prevention of oral injuries yet it may not be fully utilized. It is important that the public is made aware of this important preventive measure. The dentist plays an integral part in making the public aware of mouthguards. This study was conducted to determine the attitudes of dentists, specifically general dentists, orthodontists, and pediatric dentists, toward mouthguard use and fabrication.

In this study, 65% of all the licensed dentists in Virginia were surveyed with an overall response rate of 40%. Ideally, follow up mailings to the non-responders would have been preferred, but this was not undertaken by the authors for financial considerations. The sample of orthodontists and pediatric dentists were considerably smaller than general dentists because of the smaller total number of these specialists. The smaller sample size for the two specialty groups could not be increased because only a finite number existed and all were surveyed. The results of any survey are limited by the nature of self-reported data.

Seventy one percent of all dentists surveyed routinely recommend mouthguards for their athletically active patients. These recommendation percentages are high, but mouthguard distribution and fabrication percentages by dentists may not be comparable. A report by Seals et al. found that the total number of athletes with mouthguards fitted by dentists was 4% of the 16,871 athletes observed.<sup>6</sup> The high recommendation percentages obtained in this study also do not coincide with previous studies on mouthguard compliance by athletes. Differing studies reported 75%-100% of all oro-facial injuries occurred while the athletes were not wearing mouthguards.<sup>4,5,12</sup> One can conclude that dentists may be recommending mouthguards but patients may not be wearing them. Improved compliance by patients may be better achieved by not only recommending the use of a mouthguard but also supplying one for the patient. This can be done by either distributing stock and mouth formed mouthguards or, even better, by fabricating custom mouthguards.

The custom mouthguard is the most protective mouthguard available and is used with the greatest compliance. General dentists (59%) and pediatric dentists (56%) recommended the custom mouthguard as the primary type of mouthguard. Orthodontists recommended the stock type (77%) and the custom

**Table 4. Sporting Activities Recommended by Dentists for Mouthguard Use\***

Activities	General dentists (834) N (%)	Orthodontists (113) N (%)	Pediatric dentists (45) N (%)	All dentists (992) N (%)
Football**	556 (67)	106 (94)	37 (82)	699 (71)
Basketball	487 (58)	91(81)	34 (76)	612 (62)
Boxing**	457 (55)	89 (79)	32 (71)	578 (58)
Ice hockey**	399 (48)	76 (67)	28 (62)	503 (51)
Field hockey**	377 (45)	83 (74)	26 (58)	486 (49)
Wrestling	373 (45)	77 (68)	22 (49)	472 (48)
Martial arts	351 (42)	68 (60)	27 (60)	446 (45)
Soccer	320 (38)	69 (61)	26 (58)	415 (42)
Lacrosse**	319 (38)	68 (60)	23 (51)	410 (41)
Baseball/ softball	304 (37)	69 (61)	28 (62)	401 (40)
Roller- blading	159 (19)	21 (19)	19 (42)	199 (20)
Skate- boarding	157 (19)	23 (20)	18 (40)	198 (20)
Roller- skating	121 (15)	18 (16)	17 (38)	156 (16)
Ice skating	103 (12)	16 (14)	13 (29)	132 (13)
Volleyball	94 (11)	20 (18)	12 (27)	126 (13)
Gymnastics	93 (11)	18 (16)	11 (24)	122 (12)
Bicycling	78 (9)	10 (9)	12 (27)	100 (10)
Skiing	69 (8)	10 (9)	9 (20)	88 (9)
Water sports	48 (6)	9 (8)	7 (16)	64 (7)
Tennis	47 (6)	8 (7)	7 (16)	62 (6)
Track /Field	47 (6)	7 (6)	6 (13)	60 (6)
Other	36 (4)	7 (6)	4 (9)	47 (5)
No response	12 (1)	0 (0)	2 (4)	14 (1)
<b>Total</b>	<b>5007</b>	<b>963</b>	<b>420</b>	<b>6390</b>

\*Multiple responses were made by the participants, therefore the total number of selections is greater than the number of participants and percentages are greater than 100. Percentages are based on total number of practitioners in each category.

\*\*Contact sports with mandatory mouthguard rules.

mouthguard as a second choice (17%). Reports in the literature indicate that the custom made mouthguard is the ideal mouthguard for athletes with orthodontic appliances.<sup>6,33,34</sup> The stock form of mouthguard for the orthodontic patient, however, is seen as a more convenient mouthguard for practitioners because of the ever-changing design of the fixed appliance. A report in the literature describes a block out technique for fabricating custom mouthguards that takes into account the impending changes in the position of teeth and the presence of fixed orthodontic hardware.<sup>35</sup>

Presently, mandatory mouthguard protection exists only for the sports of football, boxing, ice hockey, field hockey, and men's lacrosse. In this study, a majority of *all dentists* reported recommending mouthguard use for the sports of football (71%), basketball (62%), boxing (58%), and ice hockey (51%) (Table 4). This concurs with reports in the literature that it would be beneficial for the sport of basketball to mandate

mouthguard wear for its participants because of the high incidence of oral injury.<sup>4,5,12-16</sup> However, less than 50% of general dentists recommended mouthguard protection for the mandated mouthguard sport of ice hockey, field hockey, or lacrosse. It should be noted that this is a statewide study and that certain sports are more popular in different regions of the country. For example, lacrosse is played at the high school and collegiate level in Virginia, but ice hockey is not. Regional biases may have some bearing on the importance practitioners placed on mouthguard protection for certain sports.

A contact sport can be defined as two or more players contacting one another at any time during a competition. Numerous articles can be cited to show the high incidence of trauma while participating in contact sports. A majority of orthodontists and pediatric dentists also reported recommending mouthguard use for the non-mandated mouthguard contact sports of martial arts, soccer, and baseball. A majority of orth-

**Table 5. Practitioner Mouthguard Preference\***

Type	General dentists (834) N (%)	Orthodontists (113) N (%)	Pediatric dentists (45) N (%)	All dentists (992) N (%)
Stock	52 (6)	87 (77)	9 (20)	148 (15)
Mouthformed	124 (15)	17 (15)	11 (24)	152 (15)
Custom made	495 (59)	19 (17)	25 (56)	539 (54)
No response	7 (1)	0 (0)	0 (0)	7 (1)
<b>Total</b>	<b>678</b>	<b>123</b>	<b>45</b>	<b>846</b>

\*Multiple responses were made by the participants, therefore the total number of selections may be greater than the number of participants and percentages may be greater than 100. Percentages are based on total number of practitioners in each category.

odontists additionally reported recommending mouth protection for wrestling. Many pediatric dentists, although not a majority, indicated recommending mouthguard use for non-contact, recreational activities. This may be due to the fact that pediatric dentists see a greater degree of emergency trauma patients in their practice. The popularity of outdoor activities (rollerblading, rock climbing, mountain biking, jet skiing, etc.) during the 1990's may warrant mouthguard protection for activities other than just contact sports.

Dentists who do not routinely recommend mouthguard protection for their athletically active patients do so for a variety of reasons. In this study, the results for orthodontists and pediatric dentists that did not recommend mouthguards was small and therefore reasons for not recommending mouthguards in these two groups may not be significant. The main reason reported for not recommending mouthguard use in this study was that the patient could obtain one from a less expensive source than the dental office (Table 5). A premium mouthguard obtained from a dental office today would most likely be the custom made type and might range in fee from

\$25-\$65. Kracht and Kaleta reported in their study that the cost for replacing or repairing a tooth in 1990 ranged from \$50-\$1,300.<sup>36</sup> Today's fees are likely higher especially if one considers implant prosthetics. The custom mouthguard may well be a worthwhile insurance for preserving a patient's natural dentition.

Twenty six percent of the general dentists that did not recommend mouthguard protection indicated that they had never received formal training on mouthguard use/or fabrication. Kumamoto and DiOrio reported in an evaluation of dental school curriculums that the majority of dental students have almost no opportunity to gain any practical experience with respect to the treatment of athletes or the fabrication of protective mouthguards.<sup>37</sup> A report by Castaldi states that dental schools have a responsibility to teach students how to fit a modern athletic mouthguard to meet the predicted growing need for mouth protection in high school and college students in accordance with the recommendation of the US Public Health Service for the year 1990.<sup>13</sup> It is the authors recommendation that dental schools should evaluate the curriculum

**Table 6. Reasons Reported by Dentists for Not Recommending Mouthguards\***

Reasons	General Dentists (276) N (%)	Orthodontists (4) N (%)	Pediatric Dentists (6) N (%)	All Dentists (286) N (%)
Patient can obtain from a less expensive source than the dental office	175 (63)	2 (50)	6 (100)	183 (64)
Received no formal training on use or fabrication	71 (26)	0 (0)	0 (0)	71 (26)
Not the responsibility of the dentist to recommend	28 (10)	0 (0)	0 (0)	28 (10)
Not profitable	16 (6)	1 (25)	0 (0)	17 (6)
No overall benefit to the patient	6 (2)	0 (0)	0 (0)	6 (2)
Other	48 (17)	1 (25)	2 (33)	51 (18)
No response	8 (3)	1 (25)	0 (0)	9 (3)
<b>Total</b>	<b>352</b>	<b>5</b>	<b>8</b>	<b>365</b>

\*Multiple responses were made by the participants, therefore the total number of selections is greater than the number of participants and percentages may be greater than 100.

for the teaching of prevention of oro-facial injuries with mouthguard fabrication.

Seventeen percent of the general dentists that did not recommend mouthguard protection indicated "other" as a reason. Many of these respondents wrote in the comment section that it was the responsibility of schools, leagues, and coaches to make these recommendations and not the dentist. Even dentists that responded to routinely recommending mouthguard protection wrote these same comments.

Approximately 10% of the general dentists that did not recommend mouthguard protection indicated that it is not the responsibility of the dentist to recommend mouthguard protection. This responsibility would fall on those (parents, coaches, league officials, etc.) less qualified to evaluate the oral cavity, and to select and properly fit a mouthguard. Parents additionally may not be aware of the high incidence of oral trauma with some recreational and athletic activities. The dentist, therefore, becomes one of the most important sources for this information. It is the recommendation of the authors of this paper that mouthguard wear should be mandated for all contact sports and be considered for non-contact sports and recreational activities where an inadvertent fall may occur. The custom mouthguard should be the preferred mouthguard of choice and dental practices should actively promote mouthguard use.

## Conclusion

1. Most dentists agree that athletically active patients require mouthguard protection. Many dentists, however, question whether they were the ones responsible for distributing and fabricating the mouthguards.

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## References

1. Nachman BM, Smith JF, Richardson FS: Football player's opinions of mouthguards. *J Am Dent Assoc* 70:62-9, 1965.
2. Godwin WC, Bagramian RA, Robinson E: The utilization of mouth-protectors by freshman football players. *J Public Health Dent* 32:22-4, 1972.
3. Heintz WD: Mouthprotectors: a progress report. *J Am Dent Assoc* 77:632-6, 1968.
4. McNutt T, Shannon SW, Wright JT, Feinstein RA: Oral trauma in adolescent athletes: a study of mouth protectors. *Pediatr Dent* 11:209-13, 1989.
5. Maestrello-deMoya MG, Primosch RE: Orofacial trauma and mouth-protector wear among high school varsity basketball players. *J Dent Childr* 56:36-9, 1989.
6. Seals RR, Marrow RM, Kuebker WA, Farney WD: An evaluation of mouthguard programs in Texas high school football. *J Am Dent Assoc* 110:904-10, 1985.
7. Ranalli DN, Lancaster DM: Attitudes of college football officials regarding NCAA mouthguard regulations and player compliance. *J Public Health Dent* 53:96-100, 1993.
8. Lancaster DM, Ranalli DN: Comparative evaluation of college football officials' attitudes toward NCAA mouthguard regulations and player compliance. *Pediatr Dent* 15:398-402, 1993.
9. Ranalli DN, Lancaster DM: Attitudes of college football coaches regarding NCAA mouthguards and player compliance. *J Public Health Dent* 55:139-42, 1995.
10. Report of joint committee on mouth protectors of the American Association of Health, Physical Education and Recreation and the American Dental Association: 1960.
11. Going RE, Loeman RE, Chan MS: Mouthguard materials: their physical and mechanical properties. *J Am Dent Assoc* 89:84-87, 1974.
12. Garon MW, Merkle A, Wright JT: Mouth protectors and oral trauma: a study of adolescent football players. *J Am Dent Assoc* 112:663-5, 1986.
13. Castaldi CR: Sport-related oral and facial injuries in the young athlete: a new challenge for the pediatric dentist. *Pediatr Dent* 8:311-6, 1986.
14. Morrow RM, Bonci T: A survey of oral injuries in female college and university athletes. *Athlet Train* 24:236-7, 1989.
15. Lee-Knight CT, Harrison EL, Price CJ: Dental injuries at the 1989 Canada Games. *J Can Dent Assoc* 61:810-5, 1992.
16. Flanders RA, Mohandas B: The incidence of orofacial injuries in sports: a pilot study in Illinois. *J Am Dent Assoc* 126:491-6, 1995.
17. Davis GT, Knott SC: Dental trauma in Australia. *Aust Dent J* 29:217-21, 1984.
18. Kramer LR: Accidents occurring in high school athletes with special reference to dental injuries. *J Am Dent Assoc* 29:1351-2, 1941.
19. American Dental Association: News of dentistry: fitted mouth guards afford key protection. *J Amer Dent Assoc* 84:531, 1972.
20. de Wet FA, Badenhorst M, Rossauw LM: Mouthguards for rugby players at primary school level. *J Dent Assoc South Africa* 36:249-53, 1981.
21. Meadow D, Lindner G, Needleman H: Oral trauma in children. *Pediatr Dent* 6:248-51, 1984.
22. Johnsen DC, Winters JE: Prevention of Intraoral trauma in sports. *Dent Clin North Am* 35:657-67, 1991.
23. Stenger JM, Lawson EA, Wright JM, Ricketts J: Mouthguards: protection against shock to head, neck, and teeth. *J Am Dent Assoc* 68:273-81, 1964.
24. Hickey JC, Morris AL, Carlson LD, Seward TE: The relation of mouth protectors to cranial pressure and deformation. *J Am Dent Assoc* 74:735-40, 1967.
25. Craig RG, Godwin WC: Physical properties of materials for custom-made mouth protectors. *J Mich Dent Assoc* 49:34-40, 1967.
26. American Society for Testing and Materials: Standard practice for care and use of mouthguards. Designation F697-80: 323, 1986.
27. Dennis CG, Parker DA: Mouthguards in Australian sport. *Aust Dent J* 17:228-35, 1972.
28. Morrow RM, Kuebker WA, Golden L, Walters FE, Day EA: Quarterback mouth guards: speech intelligibility and player preference. *Physician Sportsmed* 12:71-4, 1984.
29. Bass HB, Williams FA: A comparison of custom vs. standard mouth guards. *NY State Dent* 55:74-76, 1989.
30. Holland GJ: Custom vs. commercial mouthguard use: effect on exercise metabolic-ventilatory response of trained distance runners. *J Applied Sports Science Research* 10:100-101, 1989.
31. Kuebker WA, Morrow RM, Cohen PA: Do mouth-formed mouth guards meet the NCAA rules? *Physician Sportsmed* 14:69-74, 1986.
32. Kumamoto DP: Sports dentistry. *Compend Cont Educ Dent* 14:492-501, 1989.

33. Schoen GH: Report of committee on mouth protector project. *Bull Nassau County Dent Soc* 30:12-14, 1956.
34. Moore M: The relationship of intraoral protective devices to athletic injuries and athletic performance. *Physician Sportsmed* 10:131-6, 1982.
35. Croel TP, Castaldi CR: The custom-fitted athletic mouthguard for the orthodontic patient and for the child with a mixed dentition. *Quintessence Internat* 20:571-5, 1989.
36. Kracht CA, Kaleta AJ: The custom mouthguard. *Strategies* 4:20-22, 1991.
37. Kumamoto DP, DiOrio LP: An interprofessional learning experience in sports dentistry. *J Dent Educ* 53:491-4, 1989.

## ABSTRACT OF THE SCIENTIFIC LITERATURE



### OXYPENTIFYLLINE IN THE MANAGEMENT OF RECURRENT APHTHOUS ORAL ULCERS

This is a report from a preliminary trial examining the effectiveness of oxypentifylline for the prevention of recurrent aphthous stomatitis. Twenty-four patients participated for six weeks. These were adult patients and were give 400mg of oxypentifylline (Trental) three times daily. Sixty-three percent of the subjects reported significant relief from symptoms and recurrence of their oral lesions. Once the drug was discontinued, half of the patients reporting relief had a recurrence of their ulcers. The authors point out that recent research is focusing on a probable immune component of recurrent aphthous stomatitis. This drug suppresses the inflammatory immune response. This may have contributed to the therapeutic success observed. A double blind study is indicated. **MGP**

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**Oxypentifylline in the management of recurrent aphthous oral ulcers. Chandrasekhar J, Leim AA, et al. OOO 87:564-567, 1999.**

16 references

## ABSTRACT OF THE SCIENTIFIC LITERATURE



### ORTHODONTIC MAXILLARY EXPANSION AND ITS EFFECT ON NOCTURNAL ENURESIS

The term nocturnal enuretic describes girls over the age of five and boys over the age of six who wet their beds more than two nights per month. The spontaneous recovery rate is reported to be 15% per year. Enuresis is considered to have many causes; genetic, developmental, organic, and psychosocial factors have all been implicated by various investigators. Upper airway obstruction has been linked to nocturnal enuresis in multiple reports. In 1990, a retrospective study by Timms reported an association between rapid maxillary expansion (RME) to correct lateral crossbite and a reduction in bed-wetting at night.

This prospective study investigated the effects of RME on nocturnal enuresis of ten enuric children 8 to 13 years of age. All subjects were healthy with no bladder or sphincter function pathology. Conventional medical treatments including a wetness alarm for bed and drug therapy (ADH substitute) had been ineffective.

Pre- and post-treatment records included: mode of breathing assessment, dental casts, lateral cephalometric radiograph, and nasal resistance testing. An otolaryngologist examined nine patients, finding enlarged adenoids in one and enlarged tonsils in three children. CT scans were taken pre- and post-expansion for three patients. Eight patients had Class II malocclusions. One child had a unilateral posterior crossbite, the others had normal transverse occlusions.

A fixed screw type maxillary expander was activated twice daily for 10-15 days until posterior occlusion was close to buccal crossbite. The appliance was then replaced with a fixed lingual wire and transpalatal arch for a minimum of six months. A parental diary tracked the subject's sleeping, alertness, school performance and number of wet nights. Patients were seen monthly for one year. A written survey was completed four years after RME treatment.

Within one month of expansion, four children became completely dry and three others wet the bed less often. Parents of two of the nonresponders reported that their children slept better, had improved school performance, and more alertness. Nasal resistance improved in all subjects. No association was found between improvement in nocturnal enuresis and amount of expansion, mode of breathing, age, or nasopharyngeal dimensions (from lateral cephalogram).

At four years post-RME treatment: eight children were completely dry, one child had occasional wet nights and one 15-year-old still had nightly enuresis. The authors suggest that RME treatment should be considered for enuretic children who do not respond to conventional medical intervention.

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