

Evaluation of Cranio-cervical Posture in Children with Bruxism Before and After Bite Plate Therapy: A Pilot Project

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Abstract. [Purpose] The aim of the present study was to evaluate the effect of a biteplate on the cranio-cervical posture of children with bruxism. [Subjects and Methods] Twelve male and female children aged six to 10 years with a diagnosis of bruxism participated in this study. The children used a biteplate during sleep for 30 days and were submitted to three postural evaluations: initial, immediately following placement of the biteplate, and at the end of treatment. Posture analysis was performed with the aid of the Alcimagem[®] 2.1 program. Data analysis (IBM SPSS Statistics 2.0) involved descriptive statistics and the Student's t-test. [Results] A statistically significant difference was found between the initial cranio-cervical angle and the angle immediately following placement of the biteplate. However, no statistically significant difference was found between the initial angle and the angle after one month of biteplate usage. [Conclusion] No significant change in the cranio-cervical posture of the children was found one month of biteplate usage. However, a reduction occurred in the cranio-cervical angle when the biteplate was in position.

Key words: Bruxism, Occlusal splints, Posture

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INTRODUCTION

Studies involving children have demonstrated the importance of the development stage of the dentition, as head posture can be affected by dental occlusion^{1, 2)}. In the mixed dentition phase, changes during the development of the occlusion can result in changes in head posture³⁾. The emergence of harmful oral habits during craniofacial development can have a negative impact on function and balanced growth in childhood. Alterations of this type affect the position of the head and mandible, with a consequent effect on body posture^{4, 5)}. Parafunctional habits, such as bruxism, nail biting and non-nutritive sucking, are common among children⁶⁾ and have been associated with functional disturbances of the masticatory system during craniofacial development, which can have a profound effect on orofacial structures⁷⁾, altering the posture of the head, mandible and body. Any force exerted on the jaws should be identified as

a triggering factor of a functional imbalance in the masticatory system⁸⁾. Bruxism, in particular, causes harm to the stomatognathic system, with profound effects on orofacial structures^{9, 10)}. Moreover, bruxism is correlated with cranio-cervical alterations¹¹⁾. Other harmful oral habits, such as the continual use of chewing gum, biting finger nails, and biting on pencils or pens, are common among children and adolescents worldwide, and they have demonstrated harmful effects on the stomatognathic system when performed on a daily basis¹²⁾.

Bruxism is frequently found in children and adolescents. This habit culminates in harm to the dentition, periodontium, masticatory muscles and temporomandibular joint and may be indicative of behavioral and psychological problems^{13, 14)}. In the pediatric population, the prevalence of bruxism varies largely, depending on the method employed for the diagnosis¹⁵⁾. However, Serra-Negra et al.¹⁶⁾ estimated that at least 35.3% of Brazilian children exhibit some sign of this habit. Bruxism is defined as muscle activity of the mandible characterized by clenching and/or grinding of the teeth and has distinct manifestations: sleep bruxism and awake bruxism¹⁷⁾.

The stomatognathic system is active in chewing, breathing and speech functions, and it is directly related to the cervical spine¹⁸⁾. Thus, alterations to this system, such

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an abnormal position of the mandible, malocclusion and temporomandibular disorder, can affect the posture of the head¹⁴). The function of the stomatognathic system depends on the synergy of numerous muscles that also participate in other voluntary actions and reflexes. Consequently, mandibular function affects both occlusal balance as well as global postural balance¹⁹). The proper position of the head in space depends on three planes: the visual plane, the transverse occlusal plane (mastication) and the auricular-nasal plane. Together, these three planes maintain a parallel, horizontal relationship that ensures the stability of cranial posture through the action of mechanoreceptors in the upper cervical spine^{20–22}). However, divergent opinions are found in the literature regarding relationships among head posture, neck posture, mandible position and the stomatognathic system²¹).

A number of authors state that patients with temporomandibular disorder have a greater frequency of alterations in the positioning of the head in comparison to individuals without this disorder^{21, 22}).

Neuromuscular influences originating in cervical region and mastication actively participate in the movements of the mandible and the positioning of the neck. Mandibular movements are dictated by the neuromuscular control of the masticatory muscles¹⁹). Moreover, the stomatognathic system can be either a regulating or disturbing element for the postural system. Thus, an imbalance induced by a para-functional activity, such as bruxism, may affect the postural system, just as an imbalance in the postural system may alter the stomatognathic system. This is explained by the fact that bruxism not only affects the masticatory muscles, but all muscles of the craniofacial-neck-shoulder complex^{23, 24}). Therefore, the stomatognathic system is considered a fundamental captor of the postural system²³). Indeed, the literature reports that children with bruxism exhibit significant forward head posture, which strongly suggests a connection between bruxism and cranio-cervical posture²⁴).

A rigid occlusal splint (biteplate) is the most common form of treatment for bruxism. The aim of a biteplate is to stabilize and improve the function of the temporomandibular joint and muscles of mastication, diminish abnormal muscle activity and protect the teeth from excessive friction and traumatic loads¹²). Moreover, a biteplate can be used to promote a stable, functional joint position and ideal occlusion, which, in turn, reorganizes neuromuscular activity, reducing in abnormal activity²⁴).

The aim of the present study was to evaluate the influence of biteplate usage on the cranio-cervical posture of children with bruxism.

SUBJECTS AND METHODS

An observational, cross-sectional study was carried out following approval from the Human Research Ethics Committee of Nove de Julho University (process number: 475626). All guardians received information on the objective and procedures, and they signed a statement of informed consent authorizing the participation of their children (in compliance with Resolution 466/2012 of the Brazil-

ian National Board of Health).

Twelve male and female children between six and 10 years of age with a diagnosis of bruxism were selected at the pediatric clinic of the dental school of Nove de Julho University. The presence of bruxism was determined by parental reports of clenching and/or grinding the teeth as well as incisal and/or occlusal tooth wear, following the criteria established by the American Academy of Sleep Medicine²⁵). The inclusion criteria were a diagnosis of bruxism, mixed dentition phase, first molars in Angle class I relationship, absence of carious lesions, and absence of physical or psychological limitations that could have compromised the study. The exclusion criteria were malocclusion, neurological disorder, a health condition that caused postural alterations, prior use of an oral appliance, use of a muscle relaxer, or the presence of temporomandibular disorder or myofascial pain.

Molds were taken and a biteplate was fabricated for each child, following principles reported in the literature²⁶). The children were instructed to wear the bite plate during eight hours per night over a period of 30 consecutive days. Three postural evaluations were performed: an initial evaluation, one with the biteplate in place and one at the end of the 30 days of treatment.

Posture evaluations

All individuals received to three posture evaluations: 1) initial evaluation; 2) evaluation immediately following placement of the biteplate; and 3) evaluation at the end of the treatment period. All participants were photographed for the postural evaluation of the head and neck. The evaluation, the ALCimagem[®] 2.1 (Corel Corporation, Ottawa, Canada) software program was used²⁷). It offers a quantitative analysis of the angles in an image based on pre-determined points (markers). Photos were taken of the right side profile with the volunteer standing on a mark placed on the floor. The camera (Kodak[™] Z740 7.1) was set at a distance of 1.5 meters from the participant on a tripod with an adjustable height. Boys were bare-chested and girls wore a halter top so that the markers were clearly visible.

Semi-spherical polystyrene markers, 1.5 cm in diameter, were secured to the skin by means of double-adhesive tape on three anatomical landmarks: spinous process of the seventh cervical vertebra (C7), manubrium of the sternum (A1), and the mental protuberance (MP), as shown in Fig. 1²⁷). These markers were used to measure by which variations in the head posture at rest were observed.

Data analysis was carried out with the aid of IBM SPSS Statistics 2.0. Descriptive statistics were performed and the Student's t-test was used for comparisons among evaluation times, with the level of significance set to 95% ($p < 0.05$).

RESULTS

Twelve children aged six to ten years (mean: 7.5 ± 0.674) were evaluated. Boys accounted for 58.3% of the sample ($n = 7$) and the girls accounted for 41.7% ($n = 5$).

A statistically significant difference was found between the initial cranio-cervical angle and the angle immediately

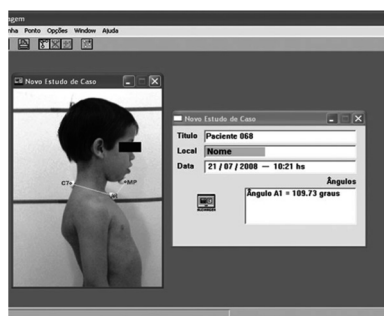


Fig. 1. Assessment of head posture using the ALCimage® software
L. J. Motta et al.²⁷⁾

following placement of the biteplate ($p = 0.000$). However, no statistically significant difference was found between the initial angle and the angle after one month of biteplate usage ($p = 0.890$) (Table 1).

DISCUSSION

According to Lobbezoo and Naeije²⁸⁾, bruxism is mainly regulated, centrally, by physiological and psychological factors that exert peripheral influences. This means that harmful oral habits, temporomandibular disorder, malocclusion, hypopnea, and high degrees of stress and anxiety exert an influence on the occurrence of this parafunctional habit. These factors act as motor stimuli to the central nervous system, which reacts with a change in the neurotransmission of dopamine, the response to which is the clenching or grinding of one's teeth²⁸⁾. Moreover, Winocur and Gavish^{6, 29)} have emphasized the potentially harmful effect of inadequate oral habits, which are common among children and adolescents, on the stomatognathic system.

In the present study, the mean angle between the spinous process of the 7th cervical vertebra, the manubrium and apex of the chin was 110.66° . Upon placement of the biteplate, this angle was diminished by approximately 2° , which indicating a reduction in the forward head posture.

According to Vélez et al.²⁴⁾, head posture and the balance in the cranio-cervical system may be affected by a parafunctional activity. Likewise, Motta et al.²⁰⁾ found greater forward head posture among children with bruxism with complete primary dentition in comparison to children without this parafunctional habit. According to Motta et al., this greater forward head posture is related to hypertonicity in the muscles of the neck. The findings of this study also suggest that bruxism can compromise cranio-cervical posture.

Changes in the axis of the head also affect the position of the mandible at rest, occlusal contacts and the optical and pupil planes. Such changes may lead to adaptive movements by the body in an attempt to establish balance and a more comfortable posture, with consequent changes in the relationships between the head and neck as well as between the neck and trunk³⁰⁾.

In the present study, the forward head posture was diminished when the biteplate was in position. This may have

Table 1. Cranio-cervical angle at different evaluation times

Patient	Age	Sex (M=1; F=2)	Initial angle	Angle with biteplate *	Final angle
1	8	1	115	112	114
2	8	1	114	110	114
3	7	2	119	117	119
4	7	1	99	100	100
5	7	2	102	100	101
6	8	1	109	108	108
7	7	2	113	111	113
8	9	2	114	112	112
9	7	1	110	108	110
10	8	1	116	113	116
11	7	2	114	112	114
12	7	1	103	100	100

Statistically significant difference between the initial cranio-cervical angles and the angles with the biteplate in place ($p = 0.000$).

Data analysis was carried out with the aid of IBM SPSS Statistics 2.0. Descriptive statistics were performed and the Student's t-test was used for comparisons among the evaluation times, with the level of significance set to 95% ($p < 0.05$).

occurred due to the fact that the biteplate had a approximate thickness of 3 mm, leading to an increase in the vertical dimension of occlusion, with a direct affect on the angle of the head³¹⁾. According to Dylina³²⁾, biteplates favor the relaxation of the musculature, allow the condyle to settle into the centric position and protect both the teeth and adjacent structures from the harmful effects of bruxism. Ambra Michelotti et al.³³⁾ have reported success achieved with biteplates. Biteplate therapy allows centric occlusion, eliminates posterior interferences, offers adequate guidance to the anterior teeth, reduces neuromuscular activity and establishes stable occlusal relationships³⁴⁾.

The position of the head and neck in relation to the trunk has a definite effect on the body. In the present study, however, the reduction in the forward head posture was not maintained after the removal of the biteplate at the end of 30 days of usage. This finding is in agreement with data described by Dylina³²⁾, who reported that, while a biteplate diminishes the load on the temporomandibular joint, it does not completely eliminate the load, nor does it prevent bruxism and or does not cure the patient. In a controlled clinical trial, Restrepo et al.³⁵⁾ employed a rigid biteplate for the treatment of children and concluded that the appliance was not effective at reducing signs of bruxism.

According to Pertes and Ross³⁶⁾, biteplate usage makes patients more aware of their functional and parafunctional behavior, drawing attention to activities that can lead to bruxism. However, the data available in the literature are insufficient to allow comparisons with the present findings.

Despite the careful placement of the markers, the cranio-cervical angle is very susceptible to any change in posture. The limitations of the present study were the selection of children who did not wear orthodontic or orthopedic appli-

ances, the difficulty in controlling biteplate usage and possible momentary respiratory problems.

No significant change in cranio-cervical posture was found in the children with after one month of biteplate usage. However, a reduction occurred in the cranio-cervical angle when the biteplate was in position, with an improvement in posture and relaxation of the musculature. Thus, further studies on postural changes in children with bruxism are needed.

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