Oral Habits—Part 2: Beyond Nutritive and Non-nutritive Sucking

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ABSTRACT

In addition to sucking habits, a range of other habits have been associated with short- and long-term dental and orthodontic problems. These habits include tongue thrusting and atypical swallowing, lip sucking, oral self-mutilation, mouth breathing, and bruxism. Although the association between form and function continues to be controversial, if habits are of sufficient duration they may lead to dental malocclusion and impede successful management. Oral self-injury and bruxism can lead to significant problems, such as soft tissue trauma and infection. Accurate history taking and examination are essential steps in formulating a diagnosis and management plan. Although a range of treatment options are often available, clear guidelines for treatment are difficult to develop due to a lack of high quality clinical trials. Optimal management is likely to be dictated by patient and severity variability. The purpose of this paper is to review and discuss the management of tongue thrust and atypical swallowing, lip sucking, oral self-mutilation, mouth breathing and bruxism.
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Oral habits in childhood may contribute to significant dental and orthodontic problems, such as soft tissue injury, tooth loss, tooth wear, anterior open bite, increased overjet, posterior crossbite, and long facial height.[1] In severe cases, repercussions may extend into adulthood.[1,2]

The purpose of this paper, the second of two on the management of habits in pediatric dentistry, is to review and discuss the management of tongue thrust and atypical swallowing, lip sucking, oral self-mutilation, mouth breathing, and bruxism. Many of these habits, particularly when more severe in nature, will benefit from multidisciplinary care and may involve referrals to orthodontists, psychologists, otolaryngologists, and myofunctional therapists.[3] Nutritive and non-nutritive sucking habits were discussed in depth in part one.

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TONGUE THRUSTING AND ATYPICAL SWALLOWING

Atypical swallowing includes 'teeth apart' swallowing and tongue thrusting, where the tongue is postured anteriorly.[4] Its association with malocclusion is controversial, with some suggesting it is a functional adaptation to malocclusion instead of the cause.[2] In infancy, the tongue is positioned anteriorly between the gum pads and rests on the lower lip to facilitate suckling in a swallow pattern often described as 'visceral' or 'infantile' swallowing.[2,5] This swallow pattern involves contraction of the muscles of the lip but little change in the tongue's posterior position.

With the eruption of teeth and introduction of solids into the diet, the swallowing pattern enters a transitional stage involving more complex movements of the tongue with greater involvement of the posterior tongue and pharyngeal muscles as well as the elevator muscles of the mandible.[2] By two to four years of age, with the eruption of the primary molars and transition to cup feeding, children start to adopt an adult or 'somatic' swallow pattern.[4] This is characterized by relaxed perioral musculature, contact of posterior teeth, and positioning of the tongue against the alveolar process behind the maxillary incisors during swallowing.

The failure of normal maturation of swallowing may lead to atypical swallowing patterns. A Slovenian longitudinal study found that the proportion of children with immature swallowing decreased from 55 percent at three years of age to 35 percent at five years.[6] An American study found that an adult swallowing pattern was achieved by 60 percent of eight-year-old children, with the remainder still in a transitional stage.[7] A range of factors—such as developmental delay and intellectual disability, anterior open bite, pacifier and digit sucking, bottle-feeding and mouth breathing—may account for the persistence of a transitional or immature swallowing pattern.[2,5] A more anterior tongue position appears to be adopted by children with enlarged tonsils and upper airway obstruction.[8]

When tongue thrusting is associated with a 'teeth apart' swallow, the resulting pattern has been described as a complex tongue thrust.[9] The presence of a complex tongue thrust has been associated with more severe malocclusion than 'teeth apart' swallowing alone.[9]

Atypical swallowing has been associated with adverse dental outcomes, such as anterior open bite, increased overjet, and posterior crossbite; however, it is not necessarily a causative relationship. To cause changes to the developing occlusion, a habit must result in forces acting for more than six hours' duration daily.[2] As such, the resting position of the tongue may be more likely to lead to malocclusion rather than the transient forces exerted during deglutition. The anterior positioning of the tongue during swallowing in the setting of an anterior open bite may be a functional adaption to form an anterior oral seal to facilitate swallowing.[2]

Diagnosis of atypical swallowing can be challenging, as swallowing patterns may change when a patient is prompted by a clinician. As such, indications of atypical swallowing, such as contractions of the facial muscles and lack of elevation of the mandible, should be noted during subconscious swallowing of saliva and water, without prompting the patient.[4] Considering its likely important role, the position of the tongue at rest should also be noted.[2]

Due to the controversy regarding the role of atypical swallowing and tongue positioning in malocclusion, there are no clear guidelines on timing, duration, or modes of treatment. Given that it may be a functional adaptation to an anterior open bite, correction of the position of the labial segments may, in some cases, lead to spontaneous resolution of the habit.[10]

Management of concurrent habits, such as non-nutritive sucking (**NNS**) and mouth breathing, may either directly or indirectly also lead to resolution of tongue thrusting. Appliance therapy, such as passive tongue cribs and functional appliances, can lead to adaptive changes, resulting in the tongue being positioned more posteriorly.[11,12] However, the use of spurs has been suggested to be more effective in altering the resting position of the tongue by triggering a pain sensation when the tongue is positioned anteriorly.[13] Although it has been used successfully in the management of tongue thrusting, its punitive nature may limit its application.[13] Myofunctional therapeutic exercises are intended to raise the patient's awareness of the habit in order to develop an improved resting position of the tongue. Although evidence is currently lacking, these exercises may be a useful adjunct to appliance therapy.[14]

Current studies seem to indicate that appliance therapy is likely to take approximately six months to correct tongue thrusting, and resolution of associated anterior open bites are most likely to occur during active growth rather than adulthood.[13]

LIP-SUCKING

Lip-sucking most commonly involves the lower lip and is characterized by excessive activity of the mentalis muscle, leading to contraction of the symphyseal tissues.[5] In most cases, the habit is relatively benign on the developing dentition.[3] The habit is often an adaptive response to increased overjet but may exacerbate the underlying sagittal discrepancy by proclining the upper incisors and retroclining the lower incisors.

Correction of the underlying discrepancy is likely to correct the habit; however, an effective orthodontic treatment plan should consider both the reasons for the lip sucking habit as well the impact on orthodontic tooth movement, particularly the persistence of the habit on the stability of treatment.[15]

If necessary, the general principles of habit management can be applied to lip-sucking habits, including the use of rewards and positive reinforcement. More advanced forms of intervention are rarely indicated due to the innocuous nature of the habit.[3]

SELF MUTILATION

Self-injury or self-mutilation is the deliberate destruction or damage to body tissues that is not associated with a conscious intent to commit suicide.[16] Oral self-injury usually involves biting of the oral or perioral structures or hands.[17] Self-inflected injury to gingival tissues due to habitual fingernail biting is also relatively common and can lead to bacterial contamination, gingival recession,

and attachment loss.[18] In extreme cases of self-injury, luxation and avulsion of teeth have been reported.[19] When committed knowingly, usually as a means of gaining attention or seeking help, the self-mutilation habit is described as functional.

Psychological therapy is an important part of treatment of functional self-injurious behavior.[19] The use of rewards and positive reinforcement, punishment, overcorrection, and alternative sensory activities are likely to succeed in some patients. However, more advanced forms of therapy are indicated in patients with moderate to advanced intellectual disability.[17] The effectiveness of pharmacological therapy, which may include antidepressants, anti-psychotics, anticonvulsants, and botulinum toxin, is often not sufficient to justify adverse effects such as excessive sedation.

Organic self-injury, by contrast, is committed unknowingly and without intention. It often occurs in the setting of an underlying systemic disease, syndrome, or disorder, including autism, Moebius syndrome, Cornelia de Lange syndrome, and, most frequently reported, Lesch-Nyhan syndrome (**LNS**; Figure 1).[20-22] Although no clear reason for self-injury has been found, one study reported greater frequency when LNS children were left alone, suggesting an environmental contribution.[23]

Figure 1. Severely injured lower lip in a child with Lesch-Nyhan syndrome.

Metabolic disturbances, such as hypersensitivity of dopaminergic receptors, increased endogenous opiate activity, and dysfunction of the serotoninergic system, have also been proposed as possible pathogenic models.[17] Oral self-injury is also common in conditions such as congenital insensitivity to pain with anhidrosis, a group of rare genetic peripheral neuropathies where loss of unmyelinated and small myelinated fibers in the peripheral nerves results in the absence of sensation to noxious stimuli.[24] Various intraoral devices, including mouthguards, acrylic splints, lip bumpers, and other custom-designed appliances, have been used with varying degrees of success (Figure 2).[17,20] These devices

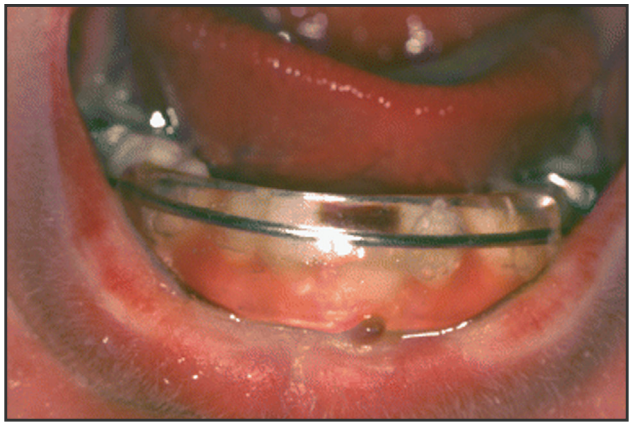

Figure 2. Lip bumper for treatment of self-mutilation in a child with Lesch-Nyhan syndrome.

protect the injured tissues while also helping to resolve the habit by impeding the ability of the patient to self-harm. Finally, a surgical approach, most commonly extraction of teeth, may be necessary in cases of severe oral self-injury that fail to respond to less invasive techniques.[22]

MOUTH BREATHING

Mouth breathing is a parafunctional habit whereby air passes through the mouth either entirely or partially rather than the nose.[25] Physiological breathing at rest normally occurs through the nose, with the lips either passively closed or two to three mm apart, and without involvement of the facial muscles.[26] Congenital causes of nasal breathing include choanal atresia, nasal atresia, and nasal septum deviations. Adenotonsillar hypertrophy, nasal polyposis, allergic conditions of the nasal passages, and malignant and benign neoplasms may be acquired causes.[25,27] Mouth breathing has also been found to be more common among asthmatic children.[28] However, mouth breathing may also occur as a habit and without any of the aforementioned physical causes.[29]

The prevalence of mouth breathing among children is difficult to estimate due to the need for observational studies utilizing complex tests. Though common in young children, its prevalence reduces with age.[29] The nature of the association between mouth breathing and malocclusion is not yet understood, although a strong association between the two has been reported.[30,31]

According to the functional matrix theory of craniofacial growth, nasal breathing ensures normal growth and development of the craniofacial structures.[32] Mouth breathing, however, results in aberrant positioning of the mandible, which is rotated downward and posteriorly, and the tongue, which is positioned downward to enable the flow of air through the oral cavity.[25,26] In a growing child, these changes manifest as distinct craniofacial features, including mandibular retrusion, increased anterior facial height, maxillary transverse deficiency,

unilateral or bilateral crossbite, and anterior open bite, and have previously been referred to as 'facies adenoidea.' The nostrils may be narrowed and the lips incompetent, with the upper lip hypotonic.[25,26,33,34] Most of these changes are due to the positioning of the mandible and tongue. The open mouth posture in mouth breathers leads to dentoalveolar compensation in the molar region, adding to growth of the lower facial height.[29]

The increased prevalence of posterior crossbite in mouth breathers has been attributed to the lower position of the tongue, which accounts for the loss of its normal influence on the growth and expansion of the maxilla as well as the increased transverse width of the mandible. The increased tension of the buccinator muscle may also contribute by exerting an inward force on the upper arch.[29,33] In addition to that, changes in the general appearance, such as an ectomorphic growth patterns with a poorly developed rib cage, sternum, and thorax and winged scapulae, may also be seen.[25,26]

Although studies in primates have shown that craniofacial abnormalities can develop when mouth breathing is induced, it is currently recognized that mouth breathing can be both the cause and result of craniofacial abnormalities, particularly where there are no obvious genetic or acquired impediments to nasal breathing.[31]

Due to increased evaporation of saliva and drying of the mouth, mouth breathing has been associated with other oral diseases and symptoms, including dental caries, gingivitis, and halitosis.[35,36] Mouth breathing results in the loss of the protective and cleansing benefits of saliva and is associated with increased gingivitis, particularly in the maxillary anterior area.[37,38] Higher dental caries rates affecting both anterior and posterior teeth have been reported in mouth-breathing children versus nose-breathing controls.[36]

Mouth breathing has been suggested as one of several factors for the increased rates of dental caries among asthmatic children.[39,40] Given the higher risk of caries and gingivitis, children who may have prolonged mouth breathing will benefit from increased use of preventive therapies, such as Tooth Mousse/MI Paste (GC Corp, Tokyo, Japan), fluoride, regular oral hygiene instruction, and dental visits.[41]

Chronic mouth breathing may be associated with sleep disorders, such as obstructive sleep apnea syndrome; consequently, children demonstrating risk factors for the habit should be assessed carefully and, when appropriate, referred to appropriate medical professionals.[25] Treatment of mouth breathing is often multidisciplinary, reflecting the range of etiological factors and can include myofunctional devices, surgical intervention, and orthodontic treatment such as rapid maxillary expansion (**RME**).[29] Although RME may reduce nasal resistance, its effectiveness is yet to be supported by robust studies.[27,42]

BRUXISM

Bruxism, which is characterized by habitual, nonfunctional, forceful, and involuntary clenching or grinding of the teeth, is an unusual parafunctional habit in children.[43] It may occur as a nocturnal or diurnal habit, and the reported prevalence among children varies between approximately nine percent to 73 percent, depending on the detection methods employed.[44] Bruxism in children may be under-reported due to a lack of awareness by parents. A study found that parents who checked on their children at night time and those who slept with doors open were more likely to report audible bruxism by their children.[45]

Although early studies emphasized the role of morphological problems, such as occlusal interferences in its etiology, bruxism is now considered to have a multifactorial etiology. It is likely to be regulated by central pathophysiological and psychological causes, which are influenced by local factors such as dental anatomy and arch-form.[44,46] Stress, anxiety, traumatic brain injury, neurological disabilities, and psychological factors, such as particular personality traits that have a tendency toward a sense of responsibility or negativity, have been reported to be associated with a higher risk of bruxism. Other factors associated with bruxism in children include oral habits such as NNS, exposure to heavy or moderate levels of second-hand smoke, and early loss of posterior teeth.[47,48]

The habit in younger children may be due to the lack of maturity of the neuromuscular function of the orofacial musculature. This condition is a known oral complication in children with cerebral palsy, who may be more vulnerable to bruxism due to muscular spasticity, hyperactivity of the masticatory muscles due to poor head positioning, poor control of mandibular position, sleep disorders, malocclusion, and use of neuroleptic drugs.[49,50] Childhood bruxism may cause a range of complications, including temporomandibular dysfunction, muscle pain, periodontal problems, tooth wear, and tooth loss. In childhood, bruxism has been established as a risk factor for temporomandibular disorder, which is, nevertheless, a rare condition among preadolescent children.[48]

There is currently little evidence for the successful management of bruxism in children.[51] Bruxism in childhood and adolescence is unlikely to persist into adulthood, although there is no clear age at which the habit is discontinued.[52-54] Among 126 six- to nine-year-old children with a bruxism habit, only 17 were found to continue bruxing five years later.[54] Similar reductions in prevalence have been reported in adolescents.[53] Most childhood bruxism is considered self-limiting. However, treatment with appliances such as occlusal splints and psychological counselling of an underlying emotional basis may be indicated if there is a high likelihood of persistence into adulthood or if complications, such as progressive tooth damage, are detected (Figure 3).[1,3]

Figure 3. An occlusal splint for treatment of bruxism in an adolescent.

The injection of botulinum toxin-A into the masseter muscles of children with special health care needs, who may be unsuitable for appliance therapy, has also been reported to effectively resolve severe bruxism.[55,56] However, the effectiveness of these interventions has not been validated.[43]

Similar to dental erosion, the management of bruxism may necessitate restorative treatment due to severe, progressive tooth wear resulting from attrition. Treatment in the primary dentition may involve the use of preformed metal crowns and extractions, whereas a more conservative approach(e.g., employing adhesive composite restorations) is preferred for permanent teeth.[57] Often, advanced behavior guidance techniques, such as the use of sedation or general anesthesia, may be necessary.[58]

CONCLUSIONS

Guidance of the developing dentition and occlusion is an important role of the pediatric dentist and starts from the child's first dental visit. A thorough understanding of common oral habits and the impact of these upon craniofacial development ensures anticipatory guidance, timely diagnosis, and appropriate management. This leads to the greatest chance of developing a healthy and esthetic dentition in adulthood. Due to the multidisciplinary nature of many habits, consultation of other health professionals may sometimes be necessary. Further studies on the association between craniofacial form and function will help pediatric dentists provide sound advice to patients and parents and ensure better management of oral habits.

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