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ORTHODONTIC MANAGEMENT OF ORAL HABITS: A REVIEW

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ABSTRACT :

Oral habits such as thumb sucking, tongue thrusting, mouth breathing, bruxism, and lip-related behaviors significantly influence dentofacial growth, occlusion, and orofacial function when persistent beyond early childhood. Their etiology is multifactorial, involving behavioral, psychological, anatomical, and neuromuscular factors, and their effects range from anterior open bite and increased overjet to maxillary constriction, deep bite, and speech or airway disturbances. Early diagnosis through thorough clinical and functional assessment is essential to prevent long-term malocclusions. Orthodontic management integrates preventive counseling, behavioral modification, myofunctional therapy, multidisciplinary collaboration, and the use of specialized habit-breaking appliances. Emerging technologies including 3D-printed appliances, AI-based habit monitoring, sensor-enabled devices, and robotic myofunctional guidance are transforming personalized treatment and improving compliance. Early intervention during primary or mixed dentition remains the most effective strategy to minimize dentoskeletal consequences and enhance long-term stability. Continued research is necessary to refine protocols and strengthen evidence-based habit management.

Keywords: Oral habits, Orthodontic intervention, Habit-breaking appliances, Myofunctional therapy, Dentofacial development

Introduction

Oral habits such as sucking, biting, thrusting, altered breathing, and other parafunctional behaviors are repetitive, non-physiologic actions of the lips, tongue, jaws, or perioral musculature that, when persistent beyond early childhood, can disrupt normal occlusal development, dentoalveolar balance, and facial growth.[1] These habits include non-nutritive digit or pacifier sucking, which generates perioral muscle activity unrelated to feeding and is strongly associated with anterior open bite, increased overjet, posterior crossbite, maxillary incisor proclination, and mandibular incisor retroclination; biting habits such as nail biting or object biting, which can contribute to incisor wear, proclination/retroclination patterns, and anterior crowding; and tongue thrusting, characterized by an infantile swallow or resting posture in which the tongue contacts teeth anterior to the molars, producing malocclusions like anterior open bite, increased overjet, and Class II tendencies.[2] Mouth breathing, often secondary to airway obstruction or habitual patterns, represents a chronic parafunctional alteration affecting the stomatognathic system and is linked to narrow maxillary arches, increased anterior facial height, and dentoalveolar protrusion. Other parafunctional activities such as bruxism, cheek or lip biting, and tongue tension further influence occlusion depending on their intensity, duration, and frequency.[3] Epidemiological studies indicate that 40–45% of children exhibit at least one deleterious oral habit, with digit sucking being more common in younger children (3–8 years), and habits like tongue thrusting, mouth breathing, and nail biting more prevalent in older children (8–12 years), while bruxism has been reported in approximately 17% of children aged 6–12 years. Early diagnosis is critical, as the primary and early mixed dentition periods offer an optimal interceptive window during which eliminating or modifying habits can prevent the establishment of significant malocclusions, reduce the need for later extractions or surgical interventions, and shorten subsequent orthodontic treatment.[4] Timely habit interception also mitigates associated concerns such as periodontal strain in crowded segments, temporomandibular dysfunction, speech disturbances, and airway-related problems. If unaddressed, persistent habits can adversely affect dentofacial growth, with digit sucking and tongue thrusting contributing to open bites, increased overjet, and posterior crossbites, while chronic mouth breathing promotes long-face patterns, altered head and tongue posture, narrowed arches, and noticeable changes in facial symmetry and profile.[5]

Typology of Oral Habits

Oral habits can be classified according to their nature, duration, intensity, and clinical presentation, with their orthodontic significance largely determined by the classic "three factors" principle frequency, duration, and force which dictates whether a habit remains harmless or becomes deforming. Based on their nature, habits may be useful, such as nasal breathing, mature swallowing, or proper tongue posture that support healthy orofacial development, or harmful, including thumb sucking, tongue thrusting, chronic mouth breathing, lip or nail biting, and bruxism, which can adversely affect occlusion and facial growth when practiced with sufficient intensity and persistence.[6] They may also be categorized as primary habits, which arise independently (such as comfort-driven digit sucking or stress-related bruxism), or secondary habits, which develop as compensation for underlying structural or functional issues for example, mouth breathing due to nasal obstruction or tongue thrust used to achieve an anterior oral seal in cases of open bite. With respect to duration and intensity, normal transient habits such as early toddler digit sucking, infantile swallowing, or occasional exploratory nail biting are generally low-intensity, short-lived behaviors that typically resolve by early childhood without causing substantial malocclusion. In contrast, persistent deleterious habits such as prolonged thumb sucking beyond 5–6 years, chronic mouth breathing, established tongue thrusting patterns, compulsive lip or nail biting, or bruxism exert more sustained pressure on teeth and supporting tissues and are capable of producing measurable dental and skeletal changes.[7]
The extent of these effects depends on the interplay of frequency (how often the habit is performed), duration (how long each episode lasts and the cumulative daily contact time), and force (the pressure exerted by the digit, tongue, lips, or jaws), with even light forces capable of moving teeth if maintained for hours daily.[8] Clinically, habits manifest in various forms: digit sucking produces characteristic features such as increased overjet, anterior open bite, maxillary arch constriction, and altered lip tone; pacifier sucking, though often easier to control, can mimic these effects when prolonged beyond early childhood; tongue thrusting, whether anterior or lateral, contributes to open bite, incisor proclination, spacing, and occasionally posterior crossbite; and mouth breathing, whether habitual or due to airway obstruction, is linked to narrow maxillary arches, increased lower facial height, incompetent lips, and higher rates of malocclusion.[9] Additional parafunctional patterns include lip biting or tucking, which may exacerbate Class II tendencies by proclining upper incisors and retroclining lower incisors; cheek biting, often unilateral and associated with stress or occlusal discrepancies; bruxism, which leads to tooth wear, sensitivity, muscle hypertrophy, and potential temporomandibular discomfort; and nail biting, which may cause incisal wear, proclination, or crowding and is often associated with other anxiety-related behaviors.[10]

Etiology, Clinical Diagnosis, and Assessment of Oral Habits

Oral habits arise from a multifactorial etiology encompassing behavioral, psychological, anatomical, neuromuscular, developmental, and genetic influences, all of which interact to shape habit formation, persistence, and orthodontic consequences. Behavioral and psychological factors play a major role, as habits such as thumb sucking, lip or nail biting, and bruxism frequently develop as comfort-seeking behaviors or responses to stress, anxiety, boredom, or imitation of family members or peers. Neuromuscular imbalances may contribute when abnormal muscle tone, poor coordination, or retained infantile swallowing patterns encourage dysfunctional behaviors such as tongue thrusting or aberrant tongue posture.[11] Anatomical conditions including enlarged adenoids, chronic nasal obstruction, short lingual frenum, or macroglossia can predispose children to mouth breathing or atypical swallowing patterns, thereby promoting open bite or other malocclusions. Developmental and functional triggers such as transitions from breastfeeding to bottle-feeding, upper respiratory infections, trauma, or adaptations to airway or structural limitations—may initiate or perpetuate habits.[12] Genetic predisposition also plays a role, with certain oral habits and dentofacial patterns showing familial clustering that suggests inherited tendencies influencing habit susceptibility and craniofacial morphology. Comprehensive clinical diagnosis involves meticulous history-taking to document habit frequency, duration, emotional triggers, age of onset, awareness, prior cessation attempts, and family history. Extraoral and intraoral examinations focus on facial form, lip competence, mentalis strain, occlusal traits such as open bite, crossbite, incisor inclinations, arch width, and resting and functional tongue posture.[13] Diagnostic aids such as cephalometric radiographs for skeletal and soft tissue evaluation, study models for occlusal assessment, video fluoroscopy for swallowing analysis, nasal patency tests for airway assessment, and photographic documentation further refine diagnosis.[14]

Dentofacial Effects of Common Oral Habits

Oral habits exert distinctive dental and skeletal effects depending on their type, intensity, and persistence, making their identification crucial in orthodontic diagnosis and treatment planning. Thumb and digit sucking commonly produces anterior open bite due to forward pressure against the anterior teeth, increases overjet through maxillary incisor proclination, narrows the maxillary arch leading to posterior crossbite, and causes retroclination of mandibular incisors as a compensatory response.[15] Tongue thrusting is largely associated with anterior open bite resulting from abnormal resting tongue posture, promotes flaring and spacing of incisors due to continuous anterior pressure, can contribute to post-treatment relapse if left uncorrected, and may cause speech disturbances such as lisping or altered sibilant sounds.[16] Mouth breathing, often arising from airway obstruction, results in a characteristic long-face pattern with increased lower facial height, a narrow V-shaped maxillary arch, posterior crossbite from transverse constriction, and low forward tongue posture that further worsens malocclusion and airway function.[17] Bruxism leads to enamel wear facets, masseter and temporalis hypertrophy, tooth mobility, and can contribute to temporomandibular joint disorders through chronic muscle overactivity and joint overload; it may also subtly affect tooth positioning over time. Lip habits, including habitual lip biting or sucking, tend to deepen the bite, retrocline maxillary incisors through excessive upper lip pressure, and proclinate mandibular incisors due to compensatory muscle activity.[18]

Orthodontic Management of Oral Habits

Orthodontic management of oral habits focuses on preventing or minimizing their detrimental effects on dentofacial growth through a coordinated blend of preventive, behavioral, interceptive, multidisciplinary, and age-appropriate strategies. Preventive measures include educating parents about normal

habit cessation timelines, monitoring habit frequency and duration, using positive reinforcement and reward systems, applying behavior modification techniques such as self-monitoring and habit reversal, and identifying or removing psychological triggers like anxiety or boredom that perpetuate harmful behaviors.[19] Interceptive and behavioral approaches such as cognitive behavioral therapy for emotional drivers, myofunctional therapy to improve tongue posture, swallowing patterns, and lip competence, speech therapy to manage articulation issues linked to tongue thrust or mouth breathing, and breathing-retraining exercises to restore nasal breathing play a crucial role in addressing functional abnormalities before they establish structural changes.[20] Effective management often requires multidisciplinary collaboration: ENT specialists assess and treat airway obstructions contributing to mouth breathing; psychologists support children with stress-related habits like bruxism or thumb sucking; pediatric dentists provide early identification and counseling; speech-language pathologists treat oromyofunctional and speech deviations; and physiotherapists specializing in orofacial myology assist in muscle rehabilitation.[21] Timing is equally critical, with early childhood to early mixed dentition (3–8 years) representing the ideal window for intervention, as habits corrected during this period harness craniofacial growth adaptability and prevent more severe malocclusions. Early correction markedly reduces the need for complex orthodontic or surgical procedures later, whereas late intervention after skeletal maturation offers limited structural improvement and mainly focuses on relapse control. Long-term stability depends on sustained habit cessation, reinforced behavior modification, appropriate retention strategies, and continuous follow-up, as recurrence of oral habits remains a common cause of orthodontic relapse.[22]

Orthodontic Appliances for Habit Control

Orthodontic appliances for habit control serve as essential tools to interrupt deleterious oral habits that influence occlusion, dentofacial growth, and functional development, and they are broadly categorized into fixed and removable types based on habit severity, expected compliance, and associated orthodontic requirements. Fixed appliances such as the palatal or tongue crib act as mechanical barriers preventing thumb placement or aberrant tongue thrusting, while the Bluegrass appliance uses a rotating bead to non-punitively redirect tongue activity and encourage conscious habit cessation.[23] More assertive devices like the hay rake appliance incorporate prongs to create discomfort during thumb sucking for patients with persistent habits, and combinations such as the quad-helix with crib simultaneously correct narrow maxillary arches while inhibiting tongue-related dysfunctions. Removable appliances, including Hawley appliances with cribs, oral screens to block lip sucking or promote nasal breathing, myofunctional trainer systems to re-educate orofacial musculature, and lip bumpers that reduce lower-lip pressure on mandibular incisors, offer flexible yet compliance-dependent solutions. Fixed devices provide continuous deterrence and are preferred for severe or resistant habits, whereas removable appliances are suitable when patient cooperation is anticipated.[24] However, fixed appliances may cause mucosal irritation and hygiene difficulties, while removable ones risk inconsistent use or loss. Treatment duration generally ranges from 6–12 months, adjusted based on the nature of the habit and patient responsiveness, and optimal long-term success requires integrating these appliances with behavioral modification and myofunctional therapy to minimize relapse and reinforce stable functional patterns.[25]

Oral Habit	**Key Clinical Effects**	**Behavioral / Preventive Approaches**	**Myofunctional / Adjunct Therapies**	**Orthodontic Appliances (Fixed & Removable)**
Thumb / Digit Sucking	↑ Overjet, anterior open bite, maxillary constriction, mandibular incisor retroclination	Habit reminders, reward charts, bitter nail solutions, parental counseling, stress reduction	Orofacial myofunctional therapy (OMT) to correct tongue posture & swallow	**Fixed:** Palatal crib, tongue crib, Bluegrass appliance, hay rake (resistant cases) **Removable:** Hawley with crib, oral screen
Pacifier Sucking	Similar to digit sucking but less severe	Gradual weaning, positive reinforcement, pacifier size reduction	OMT for normalization of oral posture	**Removable:** Oral screen, trainer appliance; **Fixed crib** if severe
Tongue Thrusting	Anterior open bite, incisor proclination, spacing, speech issues	Habit awareness training, swallow retraining	**Primary therapy:** Myofunctional therapy for tongue posture, swallow pattern, lip seal; speech therapy	**Fixed:** Tongue crib, palatal crib, modified quad-helix with crib; **Removable:** Myofunctional trainers (T4K, T4A)

Mouth Breathing	Long-face pattern, narrow maxillary arch, posterior crossbite, lip incompetence	Eliminate triggers, posture training, encourage nasal breathing	Breathing retraining (Buteyko exercises), OMT for lip seal	**Appliances for arch expansion:** Rapid maxillary expander (RME), quad-helix; Oral screen for lip training
Bruxism	Tooth wear, muscle pain, TMJ strain	Stress counseling, habit logging, sleep hygiene	Physiotherapy, relaxation exercises	**Removable:** Night guard, splint therapy
Lip Biting / Lip Sucking	Deep bite, lower incisor proclination, upper incisor retroclination	Behavior reversal therapy, reminder strategies	OMT to improve lip tone and seal	**Removable:** Oral screen; **Fixed:** Lip bumper
Cheek Biting	Mucosal trauma, unilateral occlusal changes	Stress reduction, habit awareness	OMT for neuromuscular balance	**Removable:** Bite guards, cheek shields
Nail Biting (Onychophagia)	Incisor wear, proclination, crowding	Reward systems, bitter nail coatings, stress management	OMT to reduce parafunctional load	No direct appliance; adjunct oral screen

Future Trends and Conclusion

Emerging trends in orthodontic habit control are increasingly driven by digital technologies and interdisciplinary care models that enhance personalization, monitoring, and treatment effectiveness. Customized 3D-printed habit-breaking appliances now allow clinicians to fabricate highly precise, patient-specific devices with improved comfort, rapid prototyping, and flexible design adjustments compared with traditional laboratory methods. Artificial intelligence is being incorporated into smartphone apps and wearable intraoral devices to continuously track habits such as thumb sucking, tongue thrusting, or bruxism, with AI algorithms evaluating habit frequency, duration, and intensity to provide real-time feedback and support timely intervention. Sensor-based systems integrated into appliances further enable digital tracking of muscle activity, tongue posture, and digit placement, generating data that allows orthodontists to tailor treatment remotely and improve compliance. Myofunctional robotics is an emerging field exploring robotic biofeedback devices that guide patients through precise orofacial exercises using real-time haptic or visual cues, aiming to promote neuromuscular retraining and long-term correction of dysfunctional oral habits. Early detection combined with behavioral modification and appropriately selected orthodontic appliances offers the best outcomes. Continued research is needed to optimize protocols and long-term stability.

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