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Review Article

Interrelationship between crowding and nasal breathing

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ABSTRACT:
Background: Dental crowding and nasal obstruction are increasingly recognized as interlinked phenomena in pediatric and adolescent populations.Maxillary insufficiency, characterized by an underdeveloped upper jaw, dental crowding, resulting from a lack of adequate space for teeth, and compromised nasal breathing are common yet interconnected issues that can significantly impact an individual's health and functional capabilities. Nasal breathing plays a critical role in guiding craniofacial development through proper tongue posture and orofacial muscle function. In contrast, chronic mouth breathing—often a consequence of airway obstruction—can lead to skeletal adaptations that predispose to crowding. **Aim:** This review aims to critically evaluate the literature on the relationship between nasal breathing and dental crowding, emphasizing clinical mechanisms, diagnostic considerations, and therapeutic interventions. **Key Findings:** Evidence demonstrates that nasal obstruction, whether due to adenoid hypertrophy, deviated septum, or allergic rhinitis, disrupts maxillary growth and alters occlusion. Cephalometric studies reveal narrower arches and mandibular retrusion in mouth-breathing children [29,30]. Interventions such as adenotonsillectomy and rapid maxillary expansion have been shown to reverse some of these changes when applied early. A multidisciplinary approach involving orthodontists, ENT specialists, and pediatricians is critical for effective management. **Conclusion:** Nasal breathing is fundamental to optimal dental arch development. Early screening and interdisciplinary treatment of airway obstruction can prevent or reduce the severity of crowding. Future research should focus on standardized diagnostic tools and long-term outcome evaluations.
Keywords: Nasal obstruction, Mouth breathing, Dental crowding, Maxillary constriction, Airway and malocclusion, Myofunctional therapy, Interdisciplinary management

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INTRODUCTION

Dental crowding, a form of malocclusion characterized by insufficient space for teeth alignment, is a prevalent condition in both pediatric and adult populations. While traditionally attributed to genetic and odontogenic factors, emerging literature highlights a substantial association with altered breathing patterns, particularly nasal obstruction and compensatory mouth breathing [1,2]. The nasal airway plays a central role in regulating facial development, especially during the formative years of craniofacial growth.

Physiological nasal breathing ensures optimal muscle tone of the orofacial complex, including correct tongue posture and lip seal, which promote transverse maxillary growth. However, when nasal breathing is compromised due to factors such as enlarged adenoids, deviated septum, or allergic rhinitis, children often resort to mouth breathing, disrupting this equilibrium [3]. This dysfunction can result in lowered tongue posture, hypotonic perioral muscles, and vertical maxillary excess, eventually contributing to dental arch narrowing and crowding [4].

Cephalometric and clinical studies consistently report that mouth breathers exhibit longer anterior facial height, reduced maxillary arch width, and a retrognathic mandible compared to nasal breathers [5]. In a prospective evaluation, Iwasaki et al. found a strong correlation between nasal resistance and maxillofacial form, with notable dentoalveolar compensations in children with chronic airway obstruction [6]. These morphologic changes, initiated by altered respiratory patterns, occur during the critical growth window of 5 to 12 years when skeletal adaptability is at its peak.

The association between breathing route and malocclusion is further reinforced by interdisciplinary studies involving orthodontic, otorhinolaryngologic, and pediatric assessments. Lopatienė et al. emphasized that mouth breathers had a significantly higher incidence of Class II malocclusions and constricted dental arches compared to age-matched controls with patent nasal airways [7]. Similarly, Festa et al. found a higher prevalence of posterior crossbite and crowding among mouth-breathing children, linking the condition to upper airway obstruction [8].
The pathophysiology of this association suggests that airway compromise leads to compensatory skeletal and soft tissue adaptations. Chronic oral breathing not only alters jaw growth trajectories but also impairs nasal development due to the lack of airflow stimulation in the nasal passages, further exacerbating the cycle [9]. In this context, early diagnosis and timely intervention play a critical role in preventing progression toward severe malocclusion and orthodontic complexity.
Several therapeutic strategies have shown promise in correcting or mitigating the impact of nasal obstruction. Interventions such as adenotonsillectomy, rapid maxillary expansion (RME), and orofacial myofunctional therapy not only improve airway patency but also restore favorable conditions for proper craniofacial growth and alignment [10].

Section 1: Physiology of Nasal vs. Mouth Breathing
Nasal breathing is the physiological norm and plays a vital role in craniofacial development and dental arch formation. Airflow through the nasal cavity exerts positive pressure on the lateral walls of the maxilla, promoting transverse development and maintaining equilibrium in orofacial muscle function. Proper nasal respiration allows for optimal tongue posture, typically resting against the palate, which assists in the lateral expansion of the upper arch.
When nasal airflow is compromised—due to enlarged adenoids, deviated septum, or allergic rhinitis—children shift to mouth breathing, which alters this balance. This results in low tongue posture, vertical facial growth, and reduced lateral pressure on the palatal vault, leading to maxillary constriction and increased risk of anterior dental crowding [3,4].
Further, muscle compensation mechanisms aggravate the skeletal imbalance. Chronic mouth breathing is often accompanied by increased activity of the mentalis and buccinator muscles, lip incompetence, and clockwise rotation of the mandible. These adaptations result in long face syndrome and reduced arch space, favoring crowding [4].
Cephalometric evidence shows significant alterations in skeletal morphology in mouth breathers. Iwasaki et al. demonstrated that increased nasal resistance is correlated with mandibular retrusion and altered tongue posture in Class II children, supporting a direct airway-growth interaction [6]. Trevisan et al. also observed that children with poor nasal patency had narrower palatal dimensions and increased palatal height [11].

Section 2: Mechanisms Linking Nasal Obstruction and Dental Crowding
The pathophysiology linking nasal obstruction to dental crowding is multifactorial. Upper airway obstruction—commonly due to adenoid hypertrophy, turbinate enlargement, or septal deviations—forces children to adopt mouth breathing. This compensation results in altered posture of the tongue, lips, and mandible, leading to a cascade of dentoskeletal changes.
The development of dental crowding is fundamentally linked to the interplay between jaw size, tooth size, and the dimensions of the dental arches.Research indicates that a primary factor in dental crowding is often maxillary transverse or sagittal deficiency. Maxillary arches with a transpalatal width of less than 31 mm are frequently associated with crowding.
Festa et al. reported a significantly higher prevalence of Class II malocclusions and anterior crowding among children with nasal obstruction, linked to maxillary constriction and posterior crossbite [8]. The tongue, displaced inferiorly in mouth breathers, fails to provide the necessary lateral stimulus for palatal growth, causing narrowing of the arch.
Ori et al. demonstrated that septoplasty led to measurable improvements in tongue posture and arch dimensions postoperatively, illustrating partial reversibility of malocclusion related to airway obstruction [12]. Iwasaki et al. further confirmed that pharyngeal resistance correlates with mandibular retrusion and reduced arch width [6].
Zhu et al., in a meta-analysis, confirmed that adenotonsillectomy was associated with significant increases in intercanine and intermolar widths, emphasizing the impact of airway clearance on arch development [10]. Milanesi et al. showed that over 70% of mouth-breathing children had crowding and high palates, highlighting the diagnostic utility of interdisciplinary screening [13].
In another study, Petraccone Caixeta et al. observed that post-adenotonsillectomy children showed reduced anterior crowding due to tongue repositioning and normalized intraoral pressures [14]. Osiatuma et al. corroborated this by finding a strong correlation between adenoidal hypertrophy and occlusal anomalies like crowding and posterior crossbite in Nigerian children [15].

Section 3: Clinical and Cephalometric Evidence
Clinical and radiological investigations have extensively documented the relationship between airway obstruction and dental crowding. These studies provide quantitative data on skeletal dimensions, arch width, and dental alignment, validating the developmental impact of impaired nasal breathing.
Mouth-breathing children frequently display a distinct cephalometric profile. Common features include

increased lower anterior facial height, steep mandibular plane angle, retrognathic mandible, and constricted maxillary arches. Jaiswal et al. reported significantly greater overjet and reduced intercanine width in mouth-breathing children compared to nasal breathers [5].

Lione et al. observed reduced arch width and increased palatal depth in long-term mouth breathers, using digital dental casts to quantify these traits [16]. Similarly, Diouf et al. found shorter dental arch lengths and smaller intercanine widths in children with enlarged adenoids, contributing to crowding [17].

Petraccone Caixeta et al. showed that children undergoing adenotonsillectomy demonstrated spontaneous arch widening and improved anterior alignment, without orthodontic appliances [14]. Rossi et al. found consistent reductions in dental arch dimensions and increased incisor crowding across age groups in oral breathers, reinforcing the chronic impact of airway obstruction [18].

These studies confirm that nasal obstruction has measurable skeletal and dental effects that increase the risk of crowding. Cephalometric and model-based assessments allow for early detection of these trends, enabling timely interdisciplinary interventions.

Section 4: Effects of Early Intervention

Early intervention to address upper airway obstruction plays a pivotal role in guiding proper craniofacial development and reducing the risk of dental crowding. Multiple studies support that surgical and orthopedic treatments—when applied during growth—can positively influence arch morphology and functional airway capacity.

Among the most established interventions is adenotonsillectomy, which removes physical obstructions in the nasopharyngeal airway. Zhu et al., in a comprehensive meta-analysis, showed that children who underwent adenoidectomy or tonsillectomy demonstrated statistically significant increases in intercanine and intermolar widths [10]. These dimensional improvements directly expanded the dental arch perimeter, creating more space for erupting teeth and alleviating anterior crowding.

Petraccone Caixeta et al. also evaluated children pre- and post-adenotonsillectomy and observed spontaneous improvements in arch form, tongue posture, and alignment [14]. Their findings suggest that functional correction of breathing restores the natural stimulus required for transverse maxillary growth, even in the absence of active orthodontic force.

In more structurally constricted cases, rapid maxillary expansion (RME) is often employed to orthopedically widen the midpalatal suture and increase both nasal volume and arch space. Magnusson et al. demonstrated that RME not only decreased airway resistance but also led to measurable improvements in subjective breathing and palatal width [19]. These changes translate into more favorable conditions for tooth eruption and occlusal development.

Section 5: Interdisciplinary Management Approach

Given the multifactorial nature of nasal obstruction and its impact on dental crowding, a collaborative approach between healthcare disciplines is essential for timely diagnosis and effective intervention. Pediatricians, ENT specialists, orthodontists, and speech-language pathologists all play pivotal roles in identifying early signs of dysfunction and guiding individualized management plans.

Orthodontists are often the first clinicians to observe arch narrowing, crowding, or abnormal tongue posture in growing children. However, unless the underlying etiology—often a blocked nasal airway—is addressed, orthodontic treatment may be unstable or relapse-prone. Galella et al. proposed a comprehensive evaluation model where orthodontic assessment includes screening for airway patency, tonsillar hypertrophy, tongue tie, and mouth breathing habits [20]. This integrative strategy ensures that both structural and functional factors are recognized before initiating orthodontic intervention.

Milanesi et al. developed a multidisciplinary diagnostic framework that incorporated ENT, pediatric, and dental examinations. Their screening protocol emphasized clinical features such as resting lip posture, high palatal vaults, and breathing mode at rest [13].

Speech therapists and orofacial myologists can complement these efforts, especially in cases with persistent muscle dysfunction or tongue thrusting. Corrective therapy aimed at retraining orofacial muscles can improve lip competence, correct tongue posture, and stabilize dental arch expansions.

Section 6: Research Gaps and Future Directions

While a considerable body of literature supports the association between nasal obstruction and dental crowding, several limitations in existing studies underscore the need for future research. Most available evidence is derived from observational, cross-sectional, or retrospective designs, which makes establishing a definitive causal relationship challenging. Longitudinal cohort studies tracking breathing patterns, craniofacial development, and dental outcomes from infancy through adolescence remain sparse.

One key gap lies in the lack of standardized diagnostic protocols across specialties. ENT assessments often rely on clinical examinations or nasoendoscopy, while orthodontists utilize cephalometry, CBCT, or dental arch models. Integrating these diagnostic modalities into a unified protocol could improve early detection and interdisciplinary communication.

There is also variability in the criteria used to define "mouth breathing" and "nasal obstruction" across studies. Future research should aim to use objective metrics such as rhinomanometry, nasal airflow resistance scoring, or digital posture mapping to classify breathing modes. These objective assessments could reduce diagnostic ambiguity and enhance reproducibility in comparative studies.

Another underexplored area is the long-term effectiveness of early interventions, particularly adenotonsillectomy and rapid maxillary expansion. While current evidence suggests positive short-term effects on airway volume and arch dimensions, few studies follow these patients into late adolescence or adulthood to evaluate the permanence of skeletal changes and occlusal stability.

Moreover, the role of myofunctional therapy remains promising yet inconsistently applied in clinical practice. Randomized controlled trials comparing orthodontic outcomes with and without adjunctive myofunctional therapy could provide insights into its stabilizing effect on arch development post-intervention.

Technological advances such as 3D craniofacial scanning and digital airflow modeling offer new frontiers for future studies. These tools could enhance the precision of diagnosis, allow for earlier intervention, and potentially predict patients at high risk for developing crowding based on airway and skeletal parameters.

CONCLUSION

The interplay between maxillary insufficiency, dental crowding, and nasal breathing is significant and complex, impacting an individual's facial aesthetics, oral function, and overall respiratory health. Early diagnosis and intervention are paramount in managing these interconnected conditions effectively. A comprehensive diagnostic approach that considers facial appearance, dental alignment, and respiratory function is essential for formulating an appropriate treatment plan. The relationship between nasal breathing and dental crowding is well-established, with strong evidence linking upper airway obstruction to altered craniofacial development and malocclusion. Mouth breathing during key growth phases disrupts tongue posture, impairs orofacial muscle function, and contributes to maxillary constriction, all of which create a favorable environment for crowding. Early identification of breathing dysfunctions—through clinical observation, imaging, and interdisciplinary collaboration—plays a pivotal role in prevention. Interventions such as adenotonsillectomy, rapid maxillary expansion, and myofunctional therapy have demonstrated measurable improvements in arch width and alignment when applied during growth periods. However, more longitudinal and standardized studies are needed to evaluate long-term outcomes and optimize treatment protocols. Ultimately, managing dental crowding in the context of airway obstruction requires a holistic, multidisciplinary approach that integrates functional, structural, and developmental considerations.

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