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Influence of mouthbreathing on dentofacial growth and pharyngeal airway space in children-A randomized controlled trial.

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Abstract

Introduction: Mouth breathing may cause alterations in dental and craniofacial morphology, as well their quality of life. Hence profound research has to be ca0rried out in identifying these deleterious effects and their possible treatment modalities.

Aim: This study was undertaken to evaluate and compare the dimensional changes of maxillary arch and pharyngeal airway space in healthy children aged 9-11 years.

Materials & Methods: A randomized controlled study was performed to assess the influence of mouthbreathing with occlusal variables from dental cast and cephalometric analysis.20 subjects of whom 10 were nasal breathers and 10 mouth breathers, of 9-11 years of age were selected after providing a questionnaire substantiating their breathing habits. They were subjected to clinical evaluation, dental cast analysis and cephalometric evaluation.

Results: Mouth breathers demonstrated considerable increase in palatal depth (P=0.0015) and and statistically significant narrowing of the upper arch at the level of the molar were seen in intermolar width (P=0.0294), and reduction in pharyngeal airway space(<0.05).

Conclusion: Mouth breathing during critical growth periods in children has a higher tendency for increased palatal depth and reduced pharyngeal airway space and intermolar width.

Keywords: Mouth breathers, Nasal breathers,Pharyngeal airway space, Intermolarwidth, Palatal depth

Introduction

Respiration is one of the body's vital functions and under physiological conditions breathing takes place through nose.[1] Breathing is a part of neuromuscular functional system and nasal respiration is of great significance for maintaining equilibrium of craniofacial development.[2] The nasorespiratory function can be substituted by a compensatory oral pattern due to obstructive or habitual causes.[2] In obstructive mouth breathing (MB) there is mechanical interference to the airflow passage through the upper airways and in habitual MB, there is flaccidity of the orofacial muscles with no upper airways obstruction.[3] The following three contacts play an important role for normal growth and development of the oral and nasal cavity: Competent lip seal, contact between tip of the tongue and lingual surfaces of the upper central incisors and the contact of soft palate with tongue base. [2] Buccinator, orbicularis oris and superior constrictor of the pharynx support the dental arch and also contain the tongue. When the competent lip seal cannot be observed, tongue posture is on the floor of the oral cavity (depression of the tongue), lateral expansile forces of the tongue on the palate are lost and there is unopposed medial forces of the buccinators and the masseter muscles. [4] The effect is further enhanced by a pressure differential across the hard. palate in the absence of nasal airflow, leading to a narrow and high-arched hard palate[5] Any imbalance between the buccinator mechanism and the tongue will move the teeth, leading to dental malocclusion.[6] According to the Moss[7,8] theory of the functional matrix, bone growth dynamically responds to both function and adjoining soft tissue forces.

Based on the hypothesis that the MB mode may produce dental relationship alterations, the present study is undertaken to compare the dental pattern dimensions of the nasal-breathing children and mouth breathing children.

Materials And Methods

The present study was conducted at the Department Of Pedodontics and Preventive Dentistry,Royal Dental College, Palakkad.

Selection of cases

Inclusion Criteria

Children between 9-11 years of age

No carious teeth

Exclusion criteria

Children with systemic diseases

Children with history of trauma

History of orthodontic treatment

History of nasal obstruction

The sample consisted of 20 children of both sexes from the outpatient department of Pedodontics and Preventive dentistry,Royal Dental College,Palakkad.

A questionnaire was randomly distributed among parents of children waiting in the out patient department. Based on their responses children of both genders with ages ranging from 9-11 years were selected. The children were then subjected to carry out Massler's water holding test for 3 minutes following which they were divided into nasal breathers and mouth breathers.

1. Does your child frequently experience nasal blockage?	Yes ☐	No ☐
2. Does your child sneeze frequently?	Yes ☐	No ☐
3. Does your child snore at night?	Yes ☐	No ☐
4. Does your child breathe through mouth normally?	Yes ☐	No ☐
5. Does your child struggle to breathe during sleep?	Yes ☐	No ☐
6. Does your child sleep with mouth open?	Yes ☐	No ☐
7. Does your child keep his/her mouth open while chewing?	Yes ☐	No ☐
8. Does your child have sore throat frequently?	Yes ☐	No ☐
9. Does your child's lip ever turn blue or purple while sleeping?	Yes ☐	No ☐
10. Does your child experience dry mouth while waking up?	Yes ☐	No ☐

Assessment of nasal function

Massler's water holding test:The adequacy of nasal breathing was assessed by asking the children to breathe through their nose for 3 min after putting water in their mouth and by fogging or condensation on mirror which was placed both near nose and mouth simultaneously and referred to the ENT Department where a detailed clinical and physical examination was done.(Figure 1)

Figure 1: Massler's water holding test

Assessment of dentofacial changes

The subjects were made to stand in the cephalostat (rotagraph plus) with the Frankfort Horizontal plane parallel to the floor and teeth in centric occlusion. Agfa digital X-ray film (8″ × 10″; speed E) were exposed at 72 kVp, 10 mA for 0.8 s from a fixed distance of 60 inches following the standard technique in the Department of Oral Medicine and Radiology, Royal Dental College and lateral cephalograms were taken.(Figure 2)

Figure 2:Cephalostat Imaging

Cephalometric assessment was done manually.(Figure 3).The anatomic structures were manually digitized and points were demarcated and cephalometric values were measured using Mc Namara's analysis.

Figure 3: Cephalometric tracing

McNamara Pharyngeal Airway Analysis

Upper pharyngeal width: Point on the posterior outline of the soft palate to the closest point on the pharyngeal wall.

Lower pharyngeal width: Point of intersection of the posterior border of the tongue and the inferior border of the mandible to the closest point on the posterior pharyngeal wall.(Figure 4)

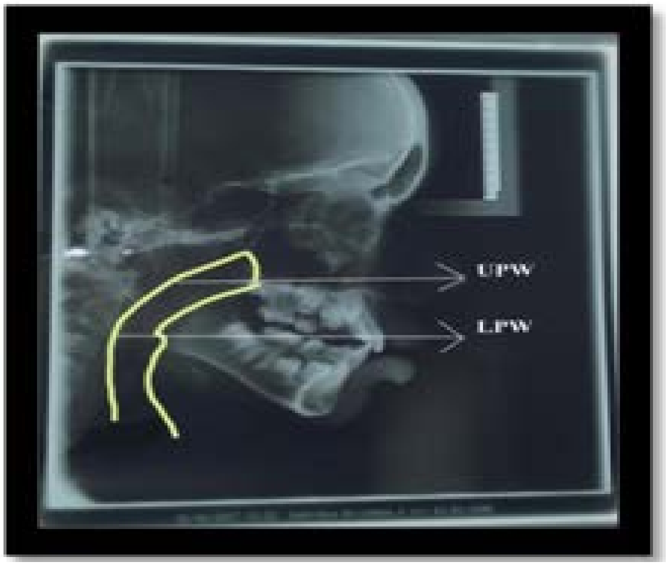

Figure 4: Mc Namara Analysis Of Pharyngeal Airway space

Assessment of study cast

Maxillary and mandibular impressions were made in the alginate impression material. .(Figure 5)The study cast thus prepared was evaluated for permanent first inter-molar width and palatal depth.(Figure 6)

Figure 5: Alginate impressions

Figure 6: Study cast

Points of reference for the measurements were:

Intermolar width: The distance measured between the central fossa of the right and left first maxillary molars.(Figure 7)

Palate depth: Two points on the palatal surfaces of the second upper primary molars at the cervical margin and a vertical rule in millimeters touching lightly on the palate.(Figure 8)

Figure 7: Intermolar width

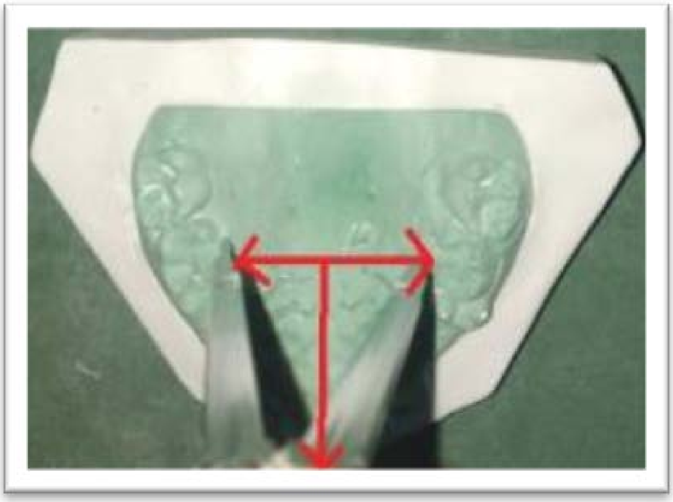

Figure 8: Palatal depth

Statistical Analysis

The quantitative analysis of the results was performed using means. The comparison between nasal breathers and mouth breathers was performed using an independent sample "t" test for parametric data. The significance level of $P < 0.05$ was chosen. (Table 1)

Measured Values	Nasal Breathers(Mean)	Mouth Breathers(Mean)	Normal Values	P Value
Upper Pharyngeal Width	12.5	9.7	11-14	<0.0001
Lower Pharyngeal Width	15.4	8.9	15-20	<0.0001
Inter-Molar Width	45.3	44	45-47	0.0294
Palatal Height	10.4	13	9-11	0.0015

Table 1: Comparative evaluation of nasal and mouth breathers.

Results

In the present study there were a total of 20 children of whom 10 were nasal breathers and 10 mouth breathers.

As shown in the table1 statistically significant differences in the variables –pharyngeal airway space (p<0.0001),intermolar width(P=0.0294) and palatal depth(P=0.0015) were seen between nasal breathers and mouth breathers. Palatal depth was found to be higher in mouth breathers when compared to nasal breathers whereas intermolar width and pharyngeal airway space was found to be significantly reduced in mouthbreathers.

Discussion

The dental professionals apprehend that faces of mouth breathers might develop aberrantly, possibly because of the disruption of normal functional relationships caused by chronic airway obstruction and altered path of airway and thereby alter the treatment outcome. [1]

Oral respiration, low tongue posture and elongation of lower anterior facial height are apparent at 3 years of age, but more commonly detected after age five. The deleterious impact of decreased naso-respiratory function is virtually complete by puberty. Hence, the age group 9-11 years is selected for the present study. [1]

With reference to the dimensions of the maxillary cast, it has been observed that inter-molar distance was statistically smaller in MB subjects, as shown in Table 1. Bresolin et al.,[4] Berwig et al.,[15] Harari et al.,[16] Lopatiene et al.,[17] and Cheng et al. [18] observed similar result in their studies. This could be attributed to the alternation in tongue posture and perioral facial musculature activity. Palatal depth was increased and statistically significant in mouth breathers, as shown in Table 1. The result corroborated with the finding of Martinez et al.,[6] Cheng et al.,[18] De Menezes et al.,[19] De Freitas,[20] and Trask et al.[21] One of the theories suggest that in obstructed mouth breathers, there is an increase in pressure in the oral cavity in relation to the nasal cavity, leading to an increase in palatal depth.

Principato[5] evaluated the upper airway obstruction and craniofacial morphology and he reported that low tongue posture seen with oral respiration impedes the lateral expansion and anterior development of the maxilla. Quinnat al.[10] stated that the effects upon nasal airflow resistance and subsequent growth are unpredictable and therefore airflow issues alone may not be a primary reason to increase the transverse dimension of the nasal base. In some of the studies, authors observed maxillary construction in patients who presented with constricted nasopharyngeal dimensions and altered respiratory function. [11]

The limitation of this study was its cross-sectional design. A methodology that can help in accurately identifying the genetic influence and along with a longitudinal study will throw light on the propensity for the presence of certain types of malocclusions. MB, apart from causing abnormal dentofacial growth, can also case medical problems. Nasal respiration is essential for production of nitric oxide, which is crucial to the overall health and efficiency of smooth muscles such as blood vessels and the heart.[21] Mouth breathers have a lower oxygen concentration in blood, which has been associated with high blood pressure and cardiac failures.[12,13]

Conclusion

The present study led to the conclusion that all subjects with mouth-breathing habit exhibited significant lower pharyngeal airway space and intermolar width with considerably increased palatal depth when compared to nasal breathers.

A multidisciplinary team should work to have early diagnosis and appropriate treatment, preventing the consequent disorders of chronic mouth breathing. Because upper airway obstruction is an obstacle to normal dentofacial development, mouth breathing children deserve prompt attention before growth has proceeded irreversibly. [1] The early recognition of such facial patterns may be utilized to identify those breathing compromised individuals who are likely to develop such types of malocclusions. The discrepancies relate to vertical components associated with palatal height and overbite, and transversely showed significantly more narrow maxillary inter-molar width. [1] Hence, earlier recognition of the changed mode of breathing would help in curtailing the development of muscular and dentofacial alterations. These alternations cause difficulty in restoring and providing stability to acceptable occlusion. After maximum facial growth has occurred, management of deviant dental patterns become increasingly complex and irreversible.

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