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Effect of Chronic Mouth Breathing On Hyoid Bone and Cervical Vertebrae: Case Report

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Abstract

Mouth breathing habit in children is on the rise due to pollution and other environmental factors. The change in breathing pattern causes malocclusion and various forms of facial disharmony. Studies have found that the position of hyoid bone changes with respect to the sagittal maxilla mandibular relationships. Thus it was established that children who breathe through the mouth tend to have a lower positioning of the tongue. The elevator muscles that attach to the hyoid bone have a central role in opening the mouth. This neuromuscular recruiting can cause changes in the mandibular rest position and neck extension, thus influencing the craniofacial growth pattern. The aim is to correlate the distance between Hyoid bone (H) and the 3rdcervical vertebrae (C3) and the curvature of the cervical spine in children with chronic mouth breathing habit and to assess the change in the C3-H value and the cervical spine curvature, in these children, with breathing exercises and oral screen therapy. 2 children in the age group of 8-11 years, who came to our dental clinic with the complaint of mouth breathing habit and had proclined anteriors, were subjected to routine preoperative lateral cephalograms. Children were diagnosed as chronic mouth breathers. Breathing exercises and oral screen therapy was started for them and the treatment effects in the C3 and H values were assessed and evaluated after 6 months. The curvature of the cervical vertebrae before and after treatment was also compared. Significant difference was observed in C3 to H distance in the cephalograms of children with chronic mouth breathing. The curvature of the cervical vertebrae showed considerable change with the cessation of the habit. The mouth breathing habit is seen to affect the craniofacial growth pattern of a child. This habit should be identified and treated, according to its aetiology, as early as possible, to avoid physical, psychological and behavioral effects on the growing child.

Keywords: Hyoid Bone, Cervical Vertebrae, Lateral Ceph, Curvature of the Spine

Introduction

Mouth breathing in children is on the rise due to pollution and other environmental factors. The change in breathing pattern during the developmental stage causes various forms of facial disharmony and malocclusion. The hyoid bone is a horse shoe shaped bone, situated on the anterior midline of the neck between symphysis and larynx, suspended from the tip of stylohyoid process of temporal bone by stylohyoid ligaments. Function of this bone is to maintain equilibrium of respiratory path by helping to keep normal head posture and serves as anchoring structure for the tongue.[1-3] The hyoid bone position could

be a good diagnostic guide to malocclusions caused by certain destructive oral habits such as mouth breathing or atypical deglutition[4,5] Hyoid bone position controls the correct ratios in the airways in individuals with different respiratory pattern. In mouth breathers, the position of the hyoid bone changes with respect to the sagittal maxillomandibular relationships. The tall part of the cervical spine and the hyoid bone are placed nearer to each other in them.[6] The elevator muscles that attach to the hyoid bone has a central role in opening the mouth. Hence in mouth breathers the hyoid bone and cervical spine relationship can change due to the open mouth posture. This neuromuscular recruiting can cause changes in the mandibular rest position and neck extension, thus influencing the craniofacial growth pattern in children, who are mouth breathers.

C3 – is the most anteroinferior point of the third cervical vertebrae. H -is the most superior and anterior point of hyoid bone. C3-H – is the Distance of hyoid bone body from third cervical vertebrae. C3-H is also the lowest limit of the air way space; hence its relevance in mouth breathers is immense.

The aim is to correlate the distance between Hyoid bone (H) and the 3rd cervical vertebrae (C3) and the curvature of the cervical spine in children with chronic mouth breathing habit and to assess the change in the C3-H value and the cervical spine curvature, in these children, with breathing exercises and oral screen therapy.

Case report

Two Children aged 8 and 11 years came to the dental clinic with chief complaints of proclined teeth and open mouth posture since 3-4years. A detailed case history was taken. Recurrent attacks of cold in childhood were given as reasons for their open mouth posture. An ENT consultation was obtained regarding the status of their breathing pattern and patency of their nostrils. The children showed clinical features such as short upper lip, proclined incisors, constricted upper arch and open mouth posture. The Jweven's butterfly test and water holding tests confirmed the patency of both the nostrils. They were classified as chronic mouth breathers and were chosen for the treatment. After getting parental consent, routine pre-operative lateral cephalograms were taken with standardized parameters. Severe curvature of the cervical spine was observed in both the children. Breathing exercises were advised to habituate the children to nasal breathing. Since short upper lip was a feature seen, lip exercises were advised. Upper and lower alginate impressions were made, for both the children, for oral screen fabrication. The patients were recalled every week for review of the exercises. For each subsequent visit breathing and lip exercises were reinforced. After ensuring that nasal breathing was comfortable for the children, Oral screen appliance was delivered. Exercises were reinforced and patients were advised to report periodically for review. After 6months of treatment lateral cephalograms were repeated to review the progress of the treatment. With exercises and oral screen therapy cervical spine curvature was seen to reduce along with change in head posture. X-rays also revealed considerable change in position of the Hyoid bone in relation to the mandibular border. The Elevator muscles had moved the Hyoid bone closer to the mandibular border with the cessation of the habit and closed posture of the mouth. Another important finding was that the third cervical vertebrae and the hyoid bone moved away from each other with the elimination of the habit. Cephalometric analysis of the pre-operative and post-operative radiographs were carried out manually to determine the C3-H value. An increase in value of C3-H was evident, with a pretreatment value of 34mmand post treatment value of 36mm, in one child and pretreatment

value of 29mm and post treatment value of 32mm in the other.(fig.1and fig.2).

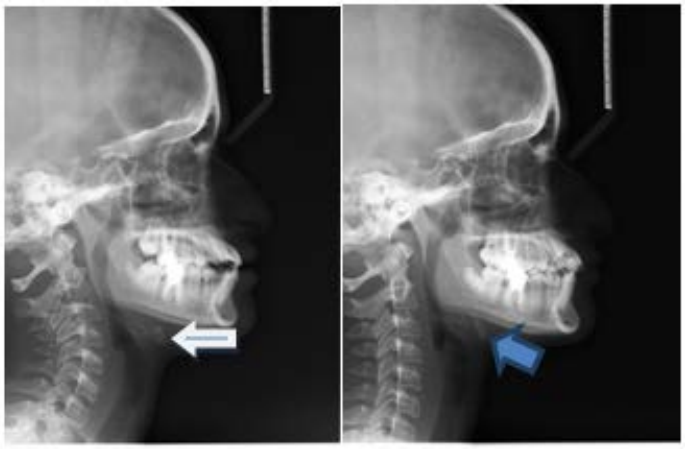

Fig. 1A: Pre-Operative **Fig.1B Post-Operative**

Fig. 2A: Pre- Operative **Fig.2B: Post-Operative**

Discussion

The curvature of the cervical spine reduced considerably along with the upward position of the head with the cessation of the mouth breathing habit. (fig.1,2) This led to the increase of the C3-H values in these children. Hyoid bone position and cervical spine can serve as an important diagnostic tool in these habits. **Sloan R** et al showed that Hyoid bone is placed somewhat more higher and ventrally to mandible, in individuals with malocclusion, as opposed to persons with neutroocclusion.[7]In our study we found that the hyoid bone moved more higher and ventrally with cessation of the mouth breathing habit. Our patients recorded a C3-H value of 36mm and 32mm post-operative respectively as the mouth breathing ceased. According to **Emsudina Deljo et al** minimum C3-H value was 30mm and maximum value was 45mm. mean value being 37.65mm in norm divergent growth pattern.[6]According to **Kumar** et al changes occur in hyoid bone position in norm divergent and hyper divergent growth patterns with pretreatment C3-H values of 32.69mm and post treatment values of 31.67mm.[8]

The third cervical vertebra and the hyoid bone were closer to each other in mouth breathers in our study. However, they moved away from each other with treatment. It was seen that the hyoid bone changes position in relation to the mandible, with treatment, which was very encouraging to note. **Toti T** et al states that Hyoid bone position control the correct ratios in the airways in individuals with different respiratory pattern.[9] This was contrary to findings by Drașovean Anca, who found that the position of the hyoid bone in anterior-posterior sense (C3-H, H-RGn) was not influenced by the breathing patternin their patients.[10] However, on vertical position, they found the hyoid bone was seen to have an inferior position in mouth breathers than in nasal breathers. Study by Isabel Chung Leng Muñoz stated that mouth breathing children seem to have an increase in anterior lower facial height, the hyoid bone in a more elevated position and higher tendency towards having a class II malocclusion compared to nasal breathing children.[11] This was contrary to what we observed in our patients, where the Hyoid bone moved higher with cessation of the mouth breathing habit. But according to Thaı´s Cristina Chaves et al asthmatic children presented higher head extension and a higher frequency of changes in hyoid bone position compared to non-asthmatic children and that greater the asthma severity, greater the extension of the upper cervical

spine.[12]Parkkinen observed lower hyoid bone position in children with breathing difficulties during sleep.[13]Several studies have reported a positive correlation between the hyoid bone position and mandible.[14,15] According to Hamayun_Zafaret al,alteration of head and neck postures had an effect on respiratory functiontoo.[16]In our case study we have found that the head posture and the curvature of the cervical spine, in mouth breathers, is so faulty that, if the habit is allowed to continue permanent irreversible effects can occur on the whole body of the individual. With the increase in curvature of the cervical spine the head position which was found to be faulty showed considerable improvement on treatment. The children we treated had a dull look and gave a history of tiredness and poor academic performance in school which seemed to improve with treatment with breathing exercises. Increase in CO_2 concentration is seen to occur, with mouth breathing habit, which has been seen to even affect the academic performance of a child.[17]The assumed Frankfort Horizontal Plane (FHP) and torticollis postures decreased the Sniff Nasal Inspiratory Pressure (SNIP) values also, compared to the normal, in mouth breathers. This can greatly influence the body posture of the child if the faulty breathing habit is allowed to continue unnoticed.[16]Extensive studies have been undertaken on mouth breathing and its effects on growing children. The effect it has can be so debilitating and severe that this habit should be recognized, and treated at the earliest, to facilitate overall proper development of the child.

Clinical significance

In our study it was found that the position of the hyoid bone moves away from the mandible, in mouth breathers, which can cause changes in the airway. In the children, the mandibular rest position and neck extension were also more than normal, thus influencing the craniofacial growth pattern, if this habit is not intervened at the earliest. However it was comforting to note that these changes could be reversed if treatment is initiated in them during their growth period.

No literature, to date, on the curvature of the cervical spine and its effect on children after breathing exercises and oral screen therapy was seen, in our search of literature. Further clinical studies are in progress involving more children with chronic mouth breathing habit to determine cephalometric changes with changes in breathing pattern.

Conclusion

Mouth breathing changes the mandibulo-maxillary relationship of a growing child. It changes the natural shape of the cervical vertebrae in them. It causes changes in the distance between the hyoid bone and third cervical vertebrae which can adversely shift the position of the head in mouth breathers. Early intervention to the mode of breathing can reverse these changes. Thus, mouth breathing habit is seen to adversely affect the craniofacial growth pattern of a child. This habit should be identified and treated, according to its etiology, as early as possible to avoid physical, psychological and behavioral effects on the growing child. Further studies should be aimed at long-term effects of mouth breathing and methods to reverse these effects if intervened with orthodontic treatment.

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