JOURNAL OF BIOLOGICAL REGULATORS & HOMEOSTATIC AGENTS Vol. 34, no. 5, 1967-1970 (2020)

LETTER TO THE EDITOR

Qualitative evaluation of vomer bone position before and after rapid maxillary expansion: a radiographic study

F. Gazzani[1], C. Pavoni[1], C. Danesi[3], G. Gastaldi[3] and R. Lione[1,2]

[1]Department of Clinical Sciences and Translational Medicine, University of Rome 'Tor Vergata', Rome, Italy; [2]Department of Dentistry UNSBC, Tirana; [3]Department of Dentistry, IRCCS San Raffaele University, Milan, Italy

Received June 25, 2020 – Accepted October 2, 2020

To the Editor,

Rapid maxillary expansion (RME) is an effective orthopedic procedure commonly used to treat maxillary transverse deficiency in growing patients (1). Transverse dentoskeletal changes are due to a separation of two halves of palatal bones across the median palatal suture. Transversal improvement of maxillary dimensions leads to a widening of nasal cavity and to an enhancement of nasal breathing (2, 3). Monson in 1898 (4) firstly described the improvements in nasal respiration after treatment with RME. Brogan (5) showed a correlation between septal deviation, crossbite, and architecture of the maxilla. In particular, high narrow palate, pointed alveolar arch, and a septal deviation were observed to the side opposite to the crossbite. According to functional matrix theory (3), nasal airflow represents a continuous stimulus for palate development and transverse maxillary growth, indicating a close relationship between nasal breathing and dentofacial morphology. The effects of RME on nasal cavity size and airway have been extensively investigated in literature (6). However, there is a paucity of findings about changes induced by RME on nasal septum (7, 8). More recently, tridimensional (3D) methods of investigation such as multislice Computed Tomography (CT) and Cone Beam Computed Tomography (CBCT) have been more frequently used to evaluate the transverse effects of RME (1). 3D techniques provide more detailed analysis of sutural areas involved in orthopedic expansion. For this reason, further investigations on CT scans would provide valuable knowledge to the existing literature on RME effects on nasal septum. This osteocartilaginous structure divides the nasal cavity into halves and is delimited by the anterior nasal spine of maxilla and frontal bone anteriorly. Nasal crest of palatine bone determines the posteroinferior region of the septum. Among the bony components, vomer bone is located inferiorly and posteriorly. It articulates with the sphenoid and the nasal crest of the maxilla and the palate. Considering the frequent involvement of vomer bone in nasal septum deformities and the close interconnection with maxillary crest, changes in its position were analyzed before and after suture orthopedic opening. Therefore, the purpose of the present study was to evaluate the effects of RME on vomer bone position by means of low-dose CT.

MATERIALS AND METHODS

A sample of 10 subjects (6 males and 4 females,

Key words: rapid maxillary expansion; vomer bone; nasal septum; maxillary deficiency; 3D imaging

Corresponding Author:
Francesca Gazzani, DDS, MS, Phd
Department of Clinical Sciences and Translational Medicine,
University of Rome Tor Vergata,
Viale Oxford 81, 00133, Rome, Italy
Tel.: +39 0620904813
e-mail: francescagazzani@hotmail.it

0393-974X (2020)

DISCLOSURE: ALL AUTHORS REPORT NO CONFLICTS OF INTEREST RELEVANT TO THIS ARTICLE.

mean age 8.5) treated with a banded RME at the University of Rome "Tor Vergata", was selected for having a moderate NSD (nasal septum deviation) at T0. All patients presented transverse maxillary deficit, variable degree of crowding, and an impacted incisor as assessed by panoramic radiographs. For each subject, the expansion screw was activated twice per day (0.4 mm) for 14 days, until overcorrection of the transverse width was achieved (palatal cusp of the upper posterior teeth approximating the buccal cusp of the lower posterior teeth). After the active phase of expansion, the appliance was left in place six months to allow for the complete ossification of the midpalatal suture. Computed tomography (CT) low dose scans were available at 2 time points for each subject: before appliance placement (T0); and at the end of active expansion (T1). The examinations were performed with the primary indication of evaluating the exact position, the three-dimensional orientation, and the spatial relationship of impacted incisors. Low-dose CT scans were taken with a scanner console (Light-Speed 16, General Electric Medical System, Milwaukee, Wisconsin, USA) with a 1.25 mm slice thickness, 13.7x13.7 cm field of view (FOV) and following a low dose protocol with 80 KV. All exams were performed at the Department of Radiology, University of Rome, "Tor Vergata", Rome with a CT scanner equipped with a Dentascan reconstruction program used to study the maxillo-facial region (Light-Speed 16, General Electric Medical System, Milwaukee, Winsconsin, USA). The study was performed under the local ethics committee approval (5, 9) and informed consent was obtained from the parents of the subjects enrolled. In order to evaluate the effects on vomer position, a method to analyzed 3D skeletal changes has been proposed. Qualitative evaluation was performed on coronal sections on the scanned images collected. In particular, the coronal scan selected was perpendicular to the bispinal plane passing through ANS-PNS and showed the palatal root and the crown of the maxillary first molars. The scans were chosen due to their ease of identification based on anatomical locations and because they could reasonably show the modality of expansion identifying the position of vomer before and after suture opening (Fig. 1).

RESULTS

The qualitative evaluation identified some common trends in the patients selected. All the subjects showed a pattern of asymmetric suture opening (Fig. 1). It was possible to observe one hemi maxilla more anchored than the other (Fig. 1). For each patient, the asymmetry in suture opening was also appreciable in the extraoral clinical photos (Fig. 2). The asymmetry in suture opening was marked in all patients selected. In most subjects, the right

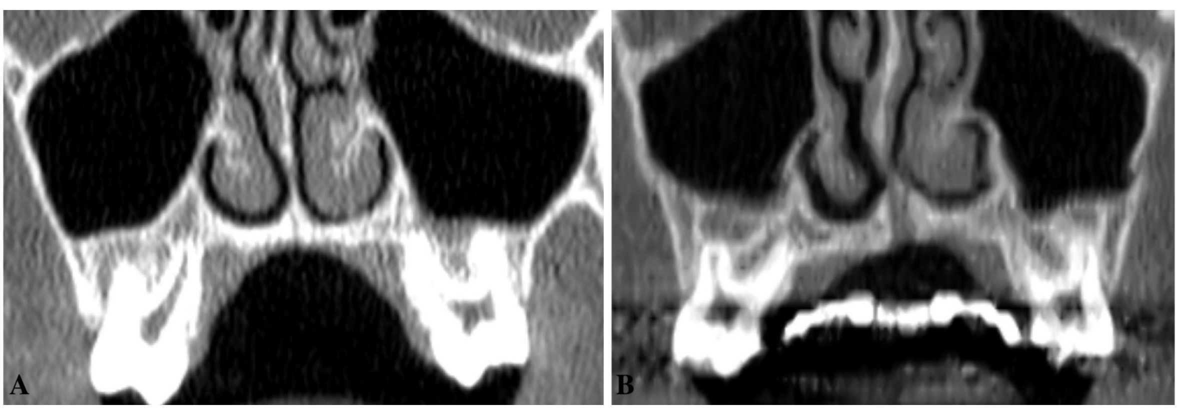

Fig. 1. *Coronal view of naso-maxillary complex before (**A**) and after (**B**) rapid maxillary expansion. B) shows the asymmetric pattern in suture opening. Right maxillary half remained more locked than the left hemi-maxilla that appeared less resistant to orthopedic forces. The vomer bone did not completely detach but remained articulated to the more anchored hemi-maxilla and palatine bones on the right side.*

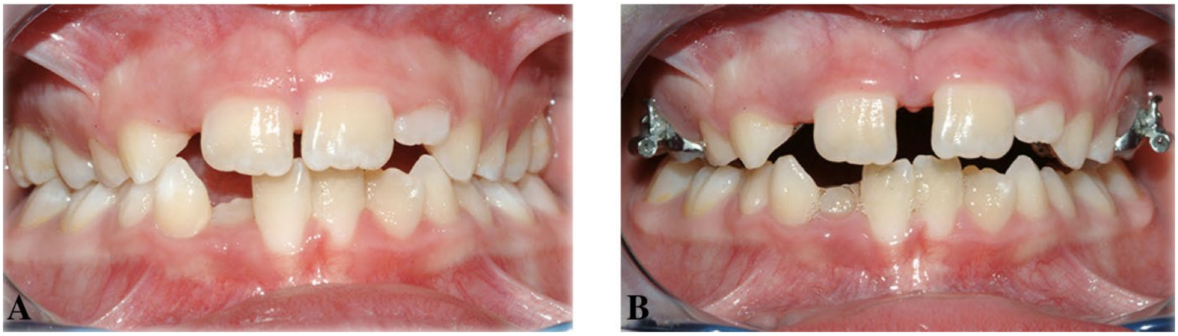

Fig. 2. *Intraoral frontal view before (**A**) and after (**B**) rapid maxillary expansion. The asymmetry in suture opening was appreciable in the significant diastema appearing between the maxillary central incisors. The transverse displacement of the left side of the upper arch was clearly more evident than the right side.*

maxillary side tended to stay locked. The left side showed less resistance during suture opening. The asymmetrical changes were also appreciable in the significant diastema appearing between the maxillary central incisors. No changes of the vomer bone position were observed; it tended to remain anchored to the more resistant side of the hemi-maxilla.

DISCUSSION

Vomer is a small, plow-shape, midline bone included the posterior part of the nasal septum. Because of its anatomical position and connections, it is frequently involved in nasal septum deviation. Positional changes of vomer bone before and after RME were evaluated in order to confirm the possibility of skeletal effects of maxillary expansion on nasal septum deviation. Maxillary structure and nasal cavity have an important anatomical connection from their initial growth phases (5). A deviation of skeletal and cartilaginous septal structures can cause a reduction of nasal airflow and interfere with maxillary growth (3, 7). Monson showed that malformed palatine processes from the top of the vault and floor of nasal cavity were often in close proximity to a distorted vomer (4). Many studies evaluated airway changes after RME, finding significant increases in nasal width and volume, and a decrement of nasal resistance with an improvement of breathing pattern (3, 9-12). However, recent results (2, 3, 9) confirmed the absence of any influence on the nasal septum. According to the present results, our qualitative evaluation showed no positional changes of vomer bone after opening suture (Fig. 1). In all patients, the vomer bone remained locked to the more resistant hemi-maxilla, remarking an evident asymmetry in suture opening. Schwarz et al. (11) based their study on the undocumented belief that the nasal septum remains attached to one side of the maxilla during expansion. Also, Palaisa et al. (10) concluded that nasal septum, vomer, and ethmoid bone did not detach but remain articulated to one of the separated maxillary and palatine bones. This evidence could suggest a smaller displacement of more posterior circum-maxillary skeletal structures with more anterior aperture width (12). The present 3D analysis could enhance the hypothesis of the absence of influence on orthopedic treatment in improving nasal septum deviation. However, a more detailed analysis of nasal septal deviation, transverse maxillary constrictions and their consequences on nasal airflow should be performed.

The findings of the present study can be summarized as follows: a pattern of asymmetric suture opening was found in all subjects; vomer bone did not change its position after RME, but it remained locked to the more resistant and anchored hemi-maxilla; from the results obtained, the absence of any association between transverse maxillary deficiencies and nasal septum deviations could be hypothesized

REFERENCES

1. V. Pangrazio-Kulbersh, P. Wine, M. Haughey, B. Pajtas, R. Kaczynski. Cone beam computed tomography evaluation of changes in the naso-maxillary complex associated with two types of maxillary expanders. Angle Orthod 2012; 82:448-57.
2. Altug-Atac AT, Atac MS, Kurt G, Karasud HA. Changes in nasal structures following orthopedic and surgically assisted rapid maxillary expansion. Int. J. Oral Maxillofac. Surg 2010; 129-35.
3. Aziz T, Ansari K, Lagravere MO, Major MP, Flores-Mir C. Effect of non-surgical maxillary expansion on the nasal septum deviation: a systematic review. Prog. Ortho 2015; 16:15.
4. Monson GS. Constricted vaults. Dental Cosmos 1898; 914-20.
5. Brogan WF. The stability of maxillary expansion. Aust Dent J 1977; 22:92-9
6. Kilic N, Oktay H. Effects of rapid maxillary expansion on nasal breathing and some naso-respiratory and breathing problems in growing children: a literature review. Int J Pediatr Otorhinolaryngol 2008; 72(11):1595-601.
7. Ballanti F, Baldini A, Ranieri S, Nota A, Cozza P. Is there a correlation between nasal septum deviation and maxillary transversal deficiency? A retrospective study on prepubertal subjects. Int J Pediatr Otorhinolaryngol 2016; 83:109-12.
8. Ballanti F, Lione R, Baccetti T, Franchi L, Cozza P. Treatment and posttreatment skeletal effects of rapid maxillary expansion investigated with low-dose computed tomography in growing subjects. Am J Orthod Dentofacial Orthop 2010; 138(3):311-17.
9. Lione R, Ballanti F, Franchi L, Baccetti T, Cozza P. Treatment and posttreatment skeletal effects of rapid maxillary expansion studied with low-dose computed tomography in growing subjects. Am J Orthod Dentofacial Orthop 2008;134(3):389-92.
10. Palaisa J, Ngan P, Martin C, Razmus T. Use of conventional tomography to evaluate changes in the nasal cavity with rapid palatal expansion. Am J Orthod Dentofacial Orthop 2007; 132:45866.
11. Schwarz GM, Thrash WJ, Byrd DL, Jacobs JD. Tomographic assessment of nasal septal changes following surgical orthodontic rapid maxillary expansion. Am J Orthod 1985; 87:39-45.
12. Bazargani F, Feldmann I, Bondemark L. Three-dimensional analysis of effects of rapid maxillary expansion on facial sutures and bones. Angle Orthod 2013; 83(6):1074-82.