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Effect of rapid maxillary expansion on the dimension of the nasal cavity and on nasal air resistance

Carla Enoki [a], Fabiana Cardoso Pereira Valera [b], Fernanda Campos Rosetti Lessa [c], Ana Maria Elias [d], Mirian Aiko N. Matsumoto [c], Wilma Terezinha Anselmo-Lima [b,*]

[a] *Department of Pathology, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil*
[b] *Department of Ophthalmology, Otorhinolaryngology and Head and Neck Surgery, Hospital das Clínicas, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil*
[c] *Department of Children's Clinical Preventive Dentistry, Faculdade de Odontologia de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil*
[d] *Department of Statistics, Faculty of Science and Letters of Araraquara/Araraquara Campus, University of São Paulo, Brazil*

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Nasal air resistance;
Rapid maxillary expansion;
Posterior crossbite

Summary

Introduction: Atresia of the maxilla is a transverse skeletal dysplasia, possibly associated with respiratory problems. For its correction, rapid maxillary expansion is a feasible orthodontic process.
Objective: To evaluate the effect of rapid maxillary expansion on the nasal cavity by acoustic rhinometry and computed rhinomanometry.
Material and methods: Twenty-nine children of both sexes with oral and/or mixed breathing, ranging in age from 7 to 10 years and with mixed dentition were selected. The children had uni- or bilateral posterior crossbite involving deciduous canines and the first permanent molars and were not being submitted to any otorhinolaryngologic or orthodontic treatment. All subjects were submitted to rhinologic exams and orthodontic documentation at three different times, i.e., before expansion and immediately and 90 days after expansion.
Results: There was no difference in the minimal cross-sectional area at the level of the valve and inferior nasal turbinate between the periods analyzed, but there was a statistically significant reduction in nasal resistance after expansion.

* Corresponding author. Tel.: +55 16 3602 2862; fax: +55 16 3602 2860.
E-mail address: mcecilia@hcrp.fmrp.usp.br (W.T. Anselmo-Lima).

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Conclusion: On the basis of the present results, we may conclude that rapid maxillary expansion may lessen the nasal resistance. Although there was no difference in nasal geometry. Thus, this procedure may improve nasal respiration, but cannot be indicated for this purpose by itself.

1. Introduction

Rapid maxillary expansion is one of the techniques most frequently used for the correction of maxillary atresia, with the purpose of increasing the width of the dental arch and of the nasal cavity.

Nasal obstruction influences the environmental conditions needed for normal growth of the nasomaxillary complex, leading to an increased vertical dimension of the face. Adequate breathing should be predominantly nasal in order to provide equilibrium in perioral muscles and the pressures and tensions of soft tissues influence the shape, size and apposition of the bone. Studies have suggested that palatine disjunction for the correction of posterior crossbite improves nasal breathing. However, few studies have correlated rapid maxillary expansion during the mixed dentition period with exams that evaluate nasal geometry and resistance.

2. Objectives

The objective of the present study was to assess the effect of rapid maxillary expansion on the nasal cavity by acoustic rhinometry and computed rhinomanometry in patients with mixed dentition.

3. Material and methods

The study is a prospective longitudinal study and was conducted on 29 white patients of both sexes with oral or mixed breathing, ranging in age from 7 to 10 years. They all had mixed dentition, with uni- or bilateral posterior crossbite involving deciduous canines and molars and the first permanent molars.

The otorhinolaryngologic diagnosis of oral breathing was made at the Service of Pediatric Rhinosinusology of the Discipline of Otorhinolaryngology, University Hospital, Faculty of Medicine of Ribeirão Preto, USP. All the patients were submitted to clinical history and exam (with anterior rhinoscopy and nasofibroscopy), acoustic rhinometry and rhimomanometry. The last two exams were carried out using the SR 2000 apparatus of Rhinometrics (Denmark), and nasal adaptors for children were used. These exams were performed without previous vasoconstriction so that we could evaluate the response of nasal mucosa to the bony expansion.

In acoustic rhinometry, the patients were instructed not to breathe during the measurements until a minimum of three valuable curves were obtained [1]. The exams were recorded on a rhinogram, with separate measurements presented on the right and on the left side. The distance was correlated to the minimal cross-sectional area (MCA), expressed in mm. The following measurements were made: MCA 1—at the level of the nasal valve, with a distance of 0—22 mm from the adaptor; MCA 2—at the level of the inferior turbinate, with a distance of 22—54 mm from the adaptor.

For rhinomanometry, the patients were oriented to breathe through their nose, and the nasal resistance was evaluated at 150 Pa, as stated by Clement et al [2], during both inspiration and expiration. Three measures were obtained.

Nasofibroscopy was performed in every patient in order to determine the pathological respiratory changes, such as hypertrophy of the inferior and middle turbinates, pharyngeal tonsils hypertrophy, nasal tumors, and septal deviations. This exam was performed after acoustic rhinometry and rhinomanometry so that vasoconstriction (used routinely for this exam in our service) and the passage of the tube through the nose would not impair the determinations made in the two other exams.

These exams were obtained before (T_1), immediately after (T_2) and 90 days after (T_3) rapid maxillary expansion.

3.1. Orthodontic procedures

Rapid maxillary expansion is indicated in orthodontics for the purpose to correct maxillary atresia. It provides an orthopedic movement of maxillary bones, opening of median palatine suture and increasing the transversal width of maxilla. The most important sites of resistance to the expansion are in adjacent structures of maxilla with craniofacial complex, particularly in zygomatic and sphenoid bones. Thus, the separation of maxillary bones becomes in a triangular form, with the basis towards the lips, and is higher anteriorly than posteriorly.