

A Review on Changes in Condylar Position after Palatal Expansion

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Abstract

Review Article

Introduction: The effects of rapid palatal expansion on condylar response is not described very well. The purpose of this review is to describe whether rapid palatal expansion has an influence on the condylar position. **Methods:** This review article describes the three main types of expanders namely Rapid palatal expansion (RPE), mini-screw assisted rapid palatal expansion (MARPE), and surgically assisted rapid palatal expansion (SARPE) and their effects on condylar position from the current literature. **Results:** The palatal expanders can have an effect on the Class II malocclusion patients in helping to decrease the overjet in some patients. It also helps in the lowering the nasal resistance and increases the airway volume. The palatal expanders can lead to molar extrusion which results in increased joint spaces in the temporomandibular joint and an alteration of condylar position. **Conclusions:** The design of expanders can influence the effects on dentition such as molar extrusion, the joint space, and the condylar position. Dentists and orthodontists can have a better discernment of effects of expanders and condylar position by understanding in detail the effects of the palatal expanders on occlusal alterations and condylar position.

Keywords: Rapid palatal expansion, condylar position, palatal expansion technique, occlusal alterations.

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INTRODUCTION

The initial reports of palatal expansion were done in 1806 by Dr. Emerson Angell, who showed that rapid palatal expansion can achieve opening of midpalatal suture [1]. He described the gap between maxillary central incisors after palatal expansion. Even though the technique of maxillary expansion was not accepted widely at that time, the expansion technique later became more popular in the 20th century [2-5]. The procedure of maxillary expansion is mainly performed for achieving greater maxillary arch width to correct the deficiency, changing the buccal root torque of posterior teeth, correction of posterior crossbite whether unilateral or bilateral, decrease resistance in nasal breathing and increase the width of maxillary sutures to aid in correction of Class II and Class III malocclusions [2-4, 6-10].

Previous studies have reported that palatal expansion does have an effect on mandibular posture in patients with unilateral crossbite [11-13]. Recently, some authors have described the effects of palatal expansion on Class II malocclusions [4-7, 10, 14]. As

palatal expansion affects mandibular posture, it also has an effect on the mandibular condyle and glenoid fossa. In growing patients, the type of expansion appliances used is the rapid palatal expansion (RPE) with an expander screw on the teeth [15]. In adults the type of expansion appliance used is the mini-screw assisted rapid palatal expansion (MARPE) which is a non-surgical expansion technique [16]. Different designs of MARPE can be used. It can be bone-borne, tooth and bone-borne, unilateral expansion, etc [17, 18]. Previously, surgically assisted rapid palatal expansion (SARPE) was used in adult which is a surgical technique and requires maxillary surgery [19]. In some cases with MARPE, micro-osteoperforations are performed in the mid palatal suture to increase the amount of expansion as osteoperforations increase bone remodeling [20, 21]. With the clinical findings and finite element analysis are performed, it is found that with expansion, there is a rapid displacement of the maxillary lateral segments which cause significant changes in the occlusal pattern and intercuspation, and subsequently functional loading of the mandibular condyles [3, 22-24].

How to evaluate the effect of expansion on Temporomandibular Joint

Magnetic Resonance Imaging can be performed to evaluate the effects on expansion on the soft-tissues of the joint such as the articular disc [25]. For the evaluation of hard tissues of the temporomandibular joint, cone beam computed tomography is the ideal radiograph as it allows three dimensional evaluation of the joint [26]. The positioning of the head is an important aspect when CBCT scans are recorded at different times to evaluate the Temporomandibular Joint (TMJ) and condyle [27, 28]. The evaluation of condylar position changes demands that the landmarks used be reproducible on the CBCT scans at different time points. The mandible is movable bone of the face, and it can get affected by palatal expansion. The recording of CBCT needs to be performed in centric occlusion during both initial and after CBCT scan. Therefore, the center of condyles need to be used when assessing the mediolateral and anteroposterior measurements [4, 7, 14, 29-33]. By assessing the distances between the stable landmarks in the skull to those on the temporomandibular joint structures, the changes in position of condyle and joint spaces can be performed

Condylar response to expansion

The effects of RPE were investigated by Arat *et al.*, who performed MRI on subjects after expansion. The authors found that there is significant condylar response to RPE after 18 weeks but there is no response in the glenoid fossa with RPE [34-36]. The expansion with MARPE on condyle and glenoid fossa were evaluated by Mehta *et al.*, who performed CBCT on the subjects from a randomized controlled clinical trial after RPE, MARPE, and controls [31]. The force distribution with RPE and MARPE is different as described in the study. The authors described the changes after 6 months as short-term results and 32 months as long-term results. The authors found that RPE led to an increase in the posterior joint space and superior joint space and increased distance of condyle to mid-sagittal plane on the left side. In the long-term, both MARPE and RPE showed an increase in superior joint space but controls did not show any changes [31]. The changes in condylar position can be attributed to the occlusal changes rather than the amount of expansion [31].

After the expansion procedure, the expansion screws are stabilized for six months and the appliance is kept in the patients mouth without activation [36]. The expansion is stopped once the crossbite is corrected and the palatal cusps of maxillary molars touch the buccal cusps of mandibular molars. A study by Rodrigues *et al.*, has shown that there is no asymmetry with expansion in patients with Class I malocclusion [37]. A forward position of the condyle has been observed after expansion procedures [4, 7, 14]. The anterior position of mandibular has been reported for different malocclusions. In some patients, it has been suggested

that RME can allow the mandible to move forward and lead to spontaneous correction of Class II Malocclusion [4, 7, 14]. McNamara *et al.*, have suggested that palatal expansion to be done even without the presence of a posterior crossbite. The reason being that the occlusal alterations that are caused by palatal expansion can lead to anterior movement of mandibular condyles and therefore a correction of the Class II malocclusion. However, Volk *et al.*, has won that this effect does not occur in all Class II patients. In some Class II patients, there is no anterior reposition of mandible after expansion [38]. This is because there are some vertical effects of expansion as well. With both MARPE and RPE, there is some degree of molar extrusion immediately after expansion and in retention period [31]. This can lead to vertical movement of dentoalveolus and mandible. The downward backward rotation of mandible may not be beneficial for the correction of Class II malocclusion [2, 3, 39, 40]. For the SARPE technique, a full-thickness flap is reflected following a sulcular incision on the deepest aspects of vestibular sulcus on the lateral aspects of maxilla. The nasal mucosa is elevated and bilateral corticotomy is performed. The effects of SARPE on condylar position are not documented in literature but Cansiz *et al.*, reported some side effects such as aspergillosis of paranasal sinus after performing SARPE [41].

Condylar position after palatal expansion

The axial images of Cone beam computed tomography scans are used to identify the position of condyle in reference to a midsagittal plane. The condyles on right and left side are both evaluated with the central reference to measure the displacement of the condyles. The study by Torres *et al.*, showed that mandibular condyle is displaced to the right side after expansion [42]. These dislocations were found to be symmetrical. The observation period in this study was 5 months. Five months is not an adequate time to observe the effects of palatal expansion appliances on the condyles. Mandible is a movable and adaptive bone and adapts to the changes with remodeling of condyle and glenoid fossa. Therefore, longer observation times after expansion are required in the studies. A recent study by Mehta *et al.*, has been conducted with a long follow up after palatal expansion on condyle and glenoid fossa [31]. Mehta *et al.*, found that RPE led to an asymmetrical movement of condyle towards the left side by 0.61 mm immediately after expansion [31]. The authors also showed an interesting observation in the long term that there was an increase in the condyle to midsagittal plane distance on both the right and left sides with RPE, MARPE, and controls indicating that growth of mandible results in this displacement of condyle bilaterally. It was concluded by the authors that the short term effects of expansion did not lead to a significant asymmetry or displacement of condyle in the long term [31].

CONCLUSION

Rapid palatal expansion causes alterations in the position of condyle in patients with posterior crossbite. The alterations can lead to correction of class II malocclusion with anterior positioning of condyles. At the same time inferior displacement of condyles can also take place with expansion. The condylar position asymmetry can be observed after palatal expansion but is not permanent and not different from controls after a long follow up. The effects of RPE and MARPE are different as the force distribution with both appliances are different.

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