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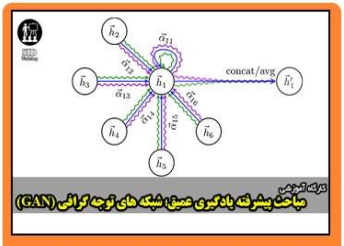

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Dentoskeletal Effects of Multi P® Prefabricated Functional Appliance on Class II Div I Children in Late Mixed Dentition

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Abstract

Objective: Prefabricated functional appliances have therapeutic effects similar to those of custom-made functional appliances. This study aimed to assess the dentoskeletal effects of Multi P® prefabricated functional appliance on Class II Div 1children in late mixed dentition.
Methods: This open label trial was conducted on 18 children aged 9-12 years with Cl II Div 1 malocclusion due to mandibular deficiency during a 9-month period. Written informed consent was obtained from the parents. Multi P ® (RMO, Strasbourg, France) was used by the patients 4 hours/day and overnight (minimum of 8 hours) in conjunction with specific exercises (pressing the teeth in the recorded occlusion, pressing the tongue against the palate and uninostril breathing). Patients were visited monthly. Study casts and cephalometric radiographs were obtained before and after the treatment. Data were analyzed using paired samples t-test and McNemar's test.
Results: The Go-Gn (P=0.029) and Me-N (P=0.021) distances significantly increased following the use of appliance while overjet (P<0.0001), absolute overbite (P=0.002) and the Wits appraisal (P=0.019) significantly decreased. Other understudy angles did not change significantly.
Conclusion: Multi P® appliance decreases the jaw base discrepancy and corrects the overjet and overbite.

Key words: Class II malocclusion, Functional appliance, Orthodontics, Eruption guidance.
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Introduction:

Class II malocclusion is among the most common orthodontic problems (1). Statistics reveal that 25-30% of children suffer from this malocclusion (2, 3). Many of these patients have class II skeletal discrepancy, parafunctional habits, soft tissue dysfunction and mouth breathing (4,5). Oral dysfunction is not only due to dental and jaw malpositioning, but is also strongly related to the increased or decreased function of the muscles that play a role in oral

function (6-9). An ideal treatment plan for correction of malocclusion requires a system or a functional appliance that is designed based on oral physiology and is capable of controlling or correcting soft tissue malfunction while fixing the jaw and dental relationships. Such appliance must have a high success rate and acceptable treatment stability (10). Initiation of treatment during the mixed dentition period provides the clinician with several treatment options (11, 12) and minimizes the need for complex orthodontic treatments in the permanent dentition period such as tooth extraction or orthognathic surgery (11-14). Also, early-onset treatment protects the incisor teeth and has positive psychological effects on patients (14). Moreover, rate of relapse in treatment with functional appliances is not as high as that of treatment with fixed appliances or heavy loads (15,16). Different appliances have been introduced for fixing Cass II Div 1 malocclusion with the common goal of correcting oral malfunction, achieving muscular balance, correcting or improving maxillary incisor protrusion and correcting the facial profile by optimally changing the mandibular growth pattern (17-19). Bergersen designed a prefabricated polyurethane elastomeric appliance for correction of malocclusion (20). This appliance was composed of a functional appliance and a positioner and introduced as an eruption guidance appliance (EGA) (2,19). The main function of a functional appliance is to induce anterior mandibular growth in order to correct Class II malocclusion in the sagittal plane while inhibiting vertical growth at the anterior region to prevent further vertical growth of the anterior teeth compared to the posterior teeth. A positioner is usually used for small dental movements following orthodontic treatment with elastomeric materials. An EGA includes a single elastomeric unit at the intercuspation of upper and lower teeth in normal occlusion (19, 20). This appliance prevents the vertical growth of maxillary anterior teeth, causes their lingual tipping, decreases the overjet and overbite and increases the inferior-anterior facial height (21). This appliance also induces small dental movements like a positioner (22,24). Multi P® (RMO Europe, Strasbourg, France) (Figure 1) is a silicone, prefabricated functional appliance (EGA) that corrects skeletal malocclusion. By having long shields, it guides the movements of crowded teeth. This appliance is flexible and autoclavable (25). Quadrelli used EGA for correction of lip position relative to the dental arch, correction of abnormal swallowing habits, prevention of cheeck traction towards the dental arch, elimination of mouth breathing, prevention of bruxism, optimal function of lateral pterygoid muscles and creation of an encourage for mandibular protrusion (6). This prefabricated functional appliance seems to have effects similar to those of functional appliances such as bionator, twin block, Fränkel regulator, Harvold activator and Herbst (14). In addition to skeletal and dentoalveolar effects, this appliance has myofunctional effects for correction of oral habits and deglutition problems. This appliance induces horizontal bone growth by means of its buccal shields via relaxing the muscles, protecting the teeth and eliminating bruxism (4).

Based on a study by Janson, no significant difference exists in the occlusal changes caused by the Fränkel appliance and EGA (2). Eruption guidance appliance is effective for correction of crowding, deep bite, Class II malocclusion and increased overjet. Normally, it requires minimal adjustment and minimal chair-side time. It requires longer follow-up intervals and the same appliance can be used for the retention period.

Clinical evidence shows favorable and stable treatment results (22). Number of studies on prefabricated functional appliances is scant. This study aimed to assess the changes caused by Multi P® prefabricated functional appliance in Class IIDiv 1 children in the late mixed dentition period.

Figure1- Multi P ® functional appliance (https://www.rmortho.com/products/multi-p/)

Methods:

This open label trial was conducted on 18 children aged 9-12 years with Class II Div1 malocclusion due to mandibular deficiency in the late mixed dentition. All parents signed written informed consent. Patients presenting to the Department of Pediatric Dentistry, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran, who had no history of previous orthodontic treatment were selected using census sampling. Subjects with systemic conditions, those who were not fully cooperative when taking impressions or during routine dental procedures and patients with the Wits appraisal <+1 were excluded from the study. Study casts were prepared and photographs, lateral cephalograms and panoramic radiographs were obtained prior to the initiation of study. According to the manufacturer's instructions, in order to select the size of appliance, the distance between the distal surfaces of maxillary lateral incisors was measured in millimeters and Multi P® (RMO Europe, Strasbourg, France) was purchased for each patient (the shape of appliance was equal for all patients, only the size was different based on individual cases). The patients were instructed to use the appliance 4 hours daily and overnight (at least 8 hours). Patients were instructed to perform specific exercises three times a day, for 30 times at each time point and 10 repetitions each time. The exercises included pressing the teeth in the recorded occlusion of the appliance, pressing the tongue against the palate and uninostrilbreathing while the patient leans against the wall with buttocks, shoulders and head touching the wall. The tongue thrusting habit of 5 patients was evaluated again at the end of the study The patients were seated on a dental chair and their occlusion and tongue position during deglutition were evaluated in the sagittal plane by retracting the lower lip. Also, 6 patients had pseudo mouth breathing. To confirm mouth breathing, patients were asked to close their mouth and breathe through one nostril. Mouth breathing was diagnosed in patients who were not capable of nasal breathing or had difficulty doing it. The patients were visited monthly to monitor their use of the appliance. Patients who did not have acceptable cooperation in terms of the duration or method of using the appliance, were excluded from the study. After 9 months, study casts were prepared and lateral cephalograms were obtained again. The casts were measured and cephalograms were traced. Data were collected and data forms were completed via interviewing the parents. Cephalometric analysis was carried out and the required data were collected using the study casts. Data were analyzed using paired samples t-test and McNemar's test. *p* values were calculated at 95% confidence interval.

Results:

Four patients were excluded from the study due to their lack of cooperation. A total of 14 patients completed the course of treatment. At 9 months, following the use of appliance, SNB significantly increased (p=0.017) while ANB significantly decreased (p=0.003). SNA did not change significantly (Tables 1). The Go-Gn and Me-N distances significantly increased following the use of appliance (p=0.029 and p=0.021, respectively) (Tables 1 and Figure 2).

Overjet (P<0.0001) and absolute overbite (P=0.002) significantly decreased post-treatment; the Wits appraisal significantly decreased as well (P=0.019) (Tables 1, Figure 3). Ar-Go-Me, facial A, PP-MP, Go-Gn-SN, FMA, upper 1 to FH, upper 1 to SN, IMPA, inter-incisal, Pog-Nperp, S-Go, Jarabak ratio, upper inter-molar distance and lower inter-molar distance did not change significantly (Table 1). Five patients had tongue thrusting; which was completely resolved at the end of the treatment course. Six patients had pseudo mouth breathing; which was resolved in 4 at the end of treatment.

Table 1. Comparison of the cephalometric values before and after treatment

	Before treatment		After treatment		Difference		p-value paired samples t-test
	Mean	SD	Mean	SD	Mean	SD	
SNA	78.9286	3.93631	78.9286	3.50196	.0000	.80861	NS*
SNB	72.2857	4.13575	73.1429	3.97312	.8571	1.16732	0.017**
ANB	6.6429	1.42003	5.7857	1.75098	-.8571	.88641	0.003**
Ar-Go-M e	131.36	5.74934	130.68	5.98912	-.6786	1.35316	NS
Facial A.	82.1429	10.40604	85.3571	3.21911	3.2143	9.82484	NS
PP- MP	30.9286	5.68350	30.1071	5.86115	-.8214	1.56411	NS
GoGn-SN	36.8929	6.09596	37.3929	6.71731	.5000	2.28709	NS
FM A	27.6071	4.99684	28.1786	4.97148	.5714	2.21756	NS
up1 to FH	111.32	8.61708	108.72	5.60465	-2.6071	6.12429	NS
up1 to SN	99.5357	8.86103	97.0357	5.89806	-2.5000	5.16274	NS
IMPA	96.2857	6.07237	99.3214	5.26457	3.0357	5.65503	NS
inter incisal A.	124.04	9.81456	123.89	6.84212	-.1429	9.25583	NS
pog-Nperp	12.1786	8.06132	9.0714	5.81066	-3.1071	6.77149	NS
Go-Gn	66.1429	4.26718	68.5000	5.34214	2.3571	3.58645	0.029**
Me-N	114.93	5.38822	116.93	6.93890	2.0000	2.85549	0.021**
S-Go	70.2143	5.52169	71.6071	6.63956	1.3929	3.03935	NS
Jarabak ratio	61.0500	4.84494	61.3214	5.11937	.2714	2.08748	NS

Before treatment

After treatment

Fig 2. Intraoral view of a patient before and after treatment

Fig 3. Lateral cephalograms of a patient before and after treatment

Discussion:

Considering the gap of information regarding the prefabricated functional appliances, this study aimed to assess the efficacy of Multi P® prefabricated functional appliance for treatment of children with Class II Div 1 malocclusion in late mixed dentition period. Class II Div 1 malocclusion is the most common orthodontic problem (1, 25) and mandibular retrusion is the most common cause of CL II malocclusion among dental and skeletal factors (24). Functional appliances have been successfully used for years in treatment of these patients (25). These appliances correct Class II malocclusion by increasing condylar growth, transposition and adaptation of fossa, neuromuscular effects and the effect of headgear on the mandibular buccal segment (14,16). Evidence shows that the best response to functional therapy occurs at the

pubertal growth peak or close to it (27). Thus, in the current study, children at the late mixed dentition period were selected. Prefabricated functional appliances are composed of a functional appliance in combination with a positioner (2) and are capable of fixing many aspects of occlusion including overbite, overjet, openbite, crossbite, Class II molar relationship and crowding (22, 27). In the current study, Multi P® prefabricated functional appliance was successfully used in Class II Div 1 malocclusion patients due to mandibular deficiency aiming to cause skeletal changes during the study period. Comparison of cephalometric indices before and after the intervention revealed skeletal changes. In addition to skeletal and soft tissue profile changes, dental changes also help achieve proper jaw relationship when using functional appliances (25, 26). However, in our study, although the upper 1 to FH, upper 1 to SN, IMPA and inter-incisal angles indicated slight protrusion of the mandibular and retrusion of the maxillary anterior teeth, these changes were not statistically significant; these findings are in contrast to the results of Keski-Nisula *et al.* (2008). In their study, using a prefabricated functional appliance led to protrusion and more anterior positioning of the mandibular anterior teeth without affecting the maxillary teeth (27). In a study by Janson *et al*. (2002) palatal tipping of the maxillary anterior teeth and buccal tipping of the mandibular anterior teeth occurred following the use of Fränkel and prefabricated functional appliances (2). Oshang *et al*. (2013) demonstrated that application of Multi P ®caused retrusion of maxillary anterior teeth while Bionator had no significant effect on the maxillary teeth (25).

Horizontal Dimension:

Increased SNB, decreased ANB and no significant change in SNA all indicated more anterior positioning of the mandible compared to its baseline position before treatment. The Wits appraisal significantly decreased as well. The mentioned changes all led to significant reduction of overjet. Decreased overjet, considering the insignificant change in upper 1 to FH, upper 1 to SN, IMPA and inter-incisal angles, is related to the anterior repositioning of the mandible. These results are in agreement with those of Ramirez-Yanes et al, and Oshagh et al. In the mentioned studies, ANB underwent a greater reduction in the multi P group; although not statistically significant, this difference was clinically important (14, 25). Moreover, Keski-Nisulaetal *et al*. (2008) reported similar results regarding the increase in mandibular length (Go-Gn) by using a prefabricated functional appliance (27). On the other hand, significant increase in Go-Gn and N-Me distances indicates increased mandibular length following the use of appliance; which confirms the findings of a meta-analysis by Perillo *et al.* (2011) on the efficacy of Fränkel appliance. They discussed that although this increase was statistically significant, the increase in length was not clinically considerable and did not compensate for the molar relationship or the retarded mandibular growth (24). In a study by Oshagh *et al.* (2013) no significant change occurred in the size of mandible (25).

Vertical Dimension:

Vertical dimension significantly increased post-treatment. The thick elastic material at the anterior segment decreases overbite (2) and in our study, overbite of patients significantly decreased, which is in accord with the results of Ramirez-Yanes et al, Oshagh *et al.* Keski-Nisula *et al*. and Janson *et al*. (2, 14, 25,27). However, in the study by Janson, post-treatment relapse of overbite was reported (2).

Oral habits:

Resolution of oral habits in 5 out of 14 patients and resolution of mouth breathing in 4 out of 14, although not statistically significant, are clinically important. The appliance in these patients worked as a reminder and resolved the oral habits.Buccal and labial shields of the

appliance eliminate the pressure of buccinators and orbicularis oris muscles and cause slight expansion of the arches. In a study by Ramirez-Yanes *et al*. (2007) using T4K prefabricated appliance stimulated the horizontal growth and subsequent rounding of the maxillary arch (14). Although in this study, increase in the upper inter-molar distance and lower inter-molar distance was not statistically significant, their clinical changes on the post-treatment study casts were evident.

Conclusion

Multi P® prefabricated functional appliance is capable of anterior repositioning of the mandible and increasing the SNB angle, decreasing the ANB angle and the Wits appraisal and consequently decreasing overjet in Class II Div 1 malocclusion patients. And is able to correct the overbite in these patients.

Conflict of Interest: "None Declared"

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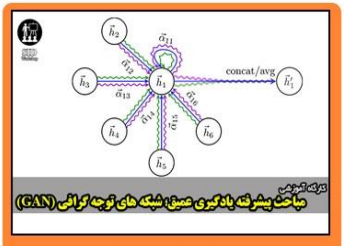

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