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Early treatment of class II division 1 malocclusion by R- appliance

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Abstract

Purpose: The purpose of this study was to assess the dentoskeletal effects of R-appliance in treatment of patients with Class II division1 in the late mixed dentition stage.
Methods and Material: The sample included twelve cases (6 females and 6 males), with average age of 10.5 years, who were treated by R-appliance for 12 months. All cases had malocclusion Class II division 1 due to mandibular retrusion. Lateral cephalograms were taken and analyzed before and after the treatment to evaluate the efficacy of the appliance.
Result: statistical analysis using the SPSS version 20.0 revealed that there was highly significant increase in SNB angle by 4.14 mm (P<0.001). The highly significant increase in mandibular length was 1.8 mm, (P= 0.003). Also, the wits appraisal was found to be significantly decreased by (p= 0.001*). The vertical measurements showed significant difference with (S- GO, N – Me, Ans –Me) by (p= <0.001*). The dentoalveolar measurements were significantly decreased with overjet around 5.42mm (P <0.001*) and statically significant with (U1-L1, U1 – SN) recorded (<0.001*) for both.
Conclusion: The study concluded that the treatment of Class II malocclusion due to mandibular deficiency by R-appliance was effective.

Keywords: Skeletal class II division1, R- appliance, Mandibular deficiency.

Introduction

Class II division 1 malocclusion represents the most common skeletal discrepancy which orthodontists were seen in daily practice. The understanding of the morphology is a key element in planning of dentofacial orthopedic treatment for this type of malocclusion.(1) Thus; Retruded Mandible, protruded maxilla, or both, as well as abnormality of dental relationships and profile change represent the most common characteristic of Class II malocclusions.(2)

Mc Namara concluded that the deficiency of anteroposterior position of the mandible rather than maxillary prognathism reflected the most common single characteristic of class II malocclusions.(3) Thus, the treatment methodology was aimed to modify growth of the mandible.(4)

The treatment options the most commonly used to correct of Class II malocclusions due to mandibular retrusion were functional appliance. There was evidence that the treatment by using removable functional devices led to correction of facial profile in Class II division 1 patients.(5)

Functional appliances were developed to change the mandibular position in sagittal and vertical directions. Thus, the functional appliances were used for treatment of sagittal and vertical malocclusions in growing patients.(6) Mandibular retrusion was the most common component of Class II malocclusion. The purpose of functional appliances was to modify growth of the mandible by anterior movement of the mandible.(3)

There are some types of functional appliances to adjust of Class II division 1 malocclusions due to mandibular retraction to encourage mandibular advance by forward movement of the mandible. According to the clinicians' preference, the type of the anomaly and growth pattern should be a selection of the appropriate appliance.(7)

The different design of R-Appliance was effective in correction of vertical growth pattern patients that overcome on disadvantages of traditional functional appliances, restriction of the maxilla, proclination of lower anterior teeth and being unsuitable in treatment of vertical.(8)

Based on what was stated above, the study was concentrated on the assessment of dentoskeletal changes as a result of R-appliance in the treatment of Class II division1 in the late mixed dentition stage.

Materials and Method

A sample of twelve cases in the late mixed dentition phase (8–12 years) selected from the clinic of Orthodontic Department, Faculty of Dentistry, Mansoura University, Egypt. The patients involved in this study had the following inclusion criteria:

- Age ranges from 8-12 years.
- Skeletal Class II division 1 due to mandibular retruded.
- Overjet more than 5mm.
- No Systemic problems.
- No Previous orthodontic treatment.
- No Abnormal oral habits.

Materials

- **Case sheet:** A paper sheet included the following information: patient's name, age, gender, case number, dental history was done
- Lateral cephalometric. Panorama x- ray, hand wrist. (Fig. 1)

- Disposable diagnostic instruments (dental Probe, mirror, tweezer).
- Suitable orthodontic trays.
- Silicon rubber base, impression material. *
- Dental stone, Exacto bite.
- The angles and lines of the lateral Cephalometric. (Fig. 2)

Fig. 1: Panorama x- ray, hand wrist

Lateral cephalometric

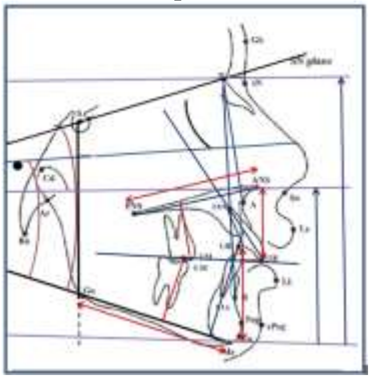

Fig. 2: Linear and angular cephalometric measurements

Parents were briefed in detail about the aim of this study, and consented to allow their kids to undergo the study. After oral examining each patient had their full diagnostic data involving photographs; Models and lateral cephalograms were done pre-and post-treatment. The hand wrist radiographs were taken for all cases before treatment to evaluate the skeletal maturation as the favorable reaction of the mandible. All previous records were taken before and directly after treatment for all participants.

Method

The construction bite was taken with maxillary and mandibular incisors teeth in an edge to edge relation by exacto-bite. (Fig. 2) Any over wax bite covering the buccal surfaces of the teeth was eliminated to allow the models to posture correctly in the construction bite. Then upper and lower working casts and exacto bite were sent to the lab to construct the R- appliance. R-appliance is a removable device consist of labial and palatal flanges, which are attached to other side by the occlusal space during bite registration. The flanges were extended to the palatal and labial side and the depth of the vestibule and the distal portion of the upper and lower molars. To avoid undercut with underlying structure, the lingual flanges were constructed with less contact as possible. The lingual thickness arch wire (1 mm diameter) was constructed to resist the load of muscular force and attached and supported right and left lower lingual flanges. A heavy wire (1 mm diameter), act as a trans palatal arch to support the appliance and placed posteriorly to right and left acrylic palatal side. The labial bow with vertical loops was constructed of 0.7 mm stainless steel wire and extended from canine to canine area (Showkatbakhsh et al., 2013).[12] (Fig. 3).

Fig. 3: Exactobite

Fig. 4: R- appliance

The retention and stability of appliance was examined and adjusted to avoid trauma to the underlying soft tissue. All patients were recurrently instructed to advance the mandible anteriorly. This position was expected as naturally adopted a comfortable situation. The anterior movement of the mandible induced growth and remodeling of the mandible, at least in the short term. The palatal flanges were constructed with less contact to insert of appliance more easily (Fig. 4).

Fig. 5: R-appliance insertion

Instructions during the treatment period: The patient was instructed to wear the appliance full time for one year except eating, and sports times. The mandible was seated permanently forward in its correct class I position for six months. The patient and parents were instructed to clean the appliance daily with soft tooth brush and to put it in cleaning solution. They were also instructed to remain in contact during emergency state (appliance fracture, looseness or pain). The patients were checked every three weeks to assess of the over jet and over bite correction.

When the over jet and overbite were treated, the appliance acted as a retainer. The second phase of treatment start after growth modification correction to relief any dental malocclusion.

Statistical analysis: Data were tabulated, coded then studied by SPSS software package version 20.0. Measurements data were described using mean, and standard deviation before and after treatment. Significance of the obtained results was less than or equal of 5%.

Result

Twelve patients of both gender, (six males and six female of the sample) used the R- appliance as their treatment appliance, with an average age (10.5 ± 1.35) years. The data in Table 1 showed that SNB angle was a significantly increased by (4.14°) (P < 0.001). Anterior movement of the pogonion point was evidenced by a highly significant statistically and significant reduced of ANB angle was evidenced statistically by (-3.61º) (P < 0.001. regarding mandibular length was a highly significant increase that was evidenced by (-1.84mm). On the other hand, non-significant differences occurred in the maxillary skeletal standards; maxillary length and SNA angle were (0.18 mm & 0.29° respectively). Regarding the vertical results in Table 2, the present study showed significant increased by (3.7, 4.9 mm) with (S- GO, Ans –Me) posterior and anterior facial height respectively, in contrast, non-significant change in the position of anterior cranial base and Frankfort line with lower border of the mandible (SN-MP, FMA). Regarding the dentoalveolar changes in Table 3, the results showed a highly significant reduction with the overjet by (5.42mm) (P < 0.001), the mandibular incisors position not effected by R-appliance, the result showed insignificant decreased with IMPA angle (0.56°), result of maxillary incisors position were a highly significant decreased in (U1-SN angle), (P =0.001) and the U1 –L1 angle was significantly increased by p=0.046. Regarding line of (U1-PP mm) was significantly increased as 1.52 and p= 0.050. The (L6 – MP was a highly significantly decreased by p<0.001. The (U6- PP, L1 – MP) lines were not significant affected.

Table 1: Means and SD of pre-and post-treatment and results of paired t-test for skeletal changes of R-appliance in children with Class II division 1 mandibular deficiency

Measurements	Pre-Treatment	Post Treatment	Changes	P
	Mean ± SD	Mean ± SD	Mean ± SD	
SNA (degree)	80.96 ± 2.2	81.7 ± 2.23	-0.76 ± 0.78	0.392
SNB(degree)	72.44 ± 2.2	76.58 ± 1.71	-4.14 ± 1.3	<0.001*
ANB(degree)	7.82 ± 1.71	5.2 ± 1.17	3.61 ± 1.42	<0.001*
Wits appraisal mm	3.26 ± 2.61	0.55 ± 2.16	2.71 ± 1.83	0.001*
Mandibular length base (mm)Go-Gn	62.69 ± 2.07	64.53 ± 2.42	-1.84 ± 1.41	0.003*
Maxillary length base (mm) Ans-Psn	45.72 ± 2.69	47.25 ± 3.30	-1.53 ± 2.58	0.093

Table 2: Means and SD of pre-and post-treatment and results of paired t-test for vertical changes of R-appliance in children with Class II division 1 mandibular deficiency

Measurements	Pre-Treatment	Post Treatment	Changes	P
	Mean ± SD	Mean ± SD	Mean ± SD	
FMA (degree)	26.84 ± 6.97	27.39 ± 6.69	-0.55 ± 1.23	0.192
SN/MP(degree)	38.69 ± 7.71	37.96 ± 7.53	0.73 ± 1.57	0.175
S- GO(mm)	67.52 ± 5.33	72.47 ± 5.32	-4.96 ± 2.14	<0.001*
N – Me(mm)	107.59 ± 6.34	112.68 ± 6.66	-5.09 ± 1.56	<0.001*
Ans –Me (mm)	60.82 ± 5.15	64.56 ± 4.11	-3.744 ± 1.83	<0.001*

Table 3: Means and SD of pre-and post-treatment and results of paired t-test for dentoalveolar changes of R-appliance in children with Class II division 1 mandibular deficiency

Measurements	Pre-Treatment	Post Treatment	Changes	P
	Mean ± SD	Mean ± SD	Mean ± SD	
Over jet(mm)	9.19 ± 1.97	3.77 ± 0.91	5.42 ± 2.00	<0.001*
Overbite (mm)	3.79 ± 1.76	3.64 ± 0.71	0.144 ± 1.71	0.796
U1/SN(degree)	106.44 ± 6.81	100.87 ± 3.33	5.57 ± 5.00	0.001*
IMPA(degree)	95.84 ± 6.15	95.28 ± 8.46	0.56 ± 4.38	0.694
U1–L1 (degree)	120.18 ± 8.34	125.72 ± 2.06	-5.54 ± 9.38	0.046*
U1 – PP(mm)	27.26 ± 2.27	28.78 ± 2.15	-1.52 ± 2.64	0.050*
L1– Mp(mm)	38.93 ± 2.84	39.24 ± 3.10	-.305 ± 2.95	0.705
L6 – Mp(mm)	27.99 ± 1.64	26.85 ± 1.50	1.14 ± 0.62	<0.001*
U6 – PP(mm)	20.10 ± 1.74	19.93 ± 1.62	0.17 ± 1.15	0.589

p: p values for **Paired t-test** for comparing between Pre-Treatment and Post Treatment

*: Statistically significant at $p \leq 0.05$

Case presentation:

Pre-treatment Post –treatment

Pre- Treatment **Post- Treatment**

Discussion

Discrepancies of maxillomandibular jaws in progress of the occlusion play an essential role in induce of class II division 1 malocclusion. Some studies[3] showed that the most common of class II had mandibular retruded. Replacement of mandible position could be stimulating mandibular growth as a result of treatment class II malocclusion.[9]

The R-appliance in this study was efficient in treatment of Class II division 1 due to mandibular deficiency without labial tipping of lower anterior teeth and improved the skeletal intermaxillary discrepancy. The results of current study revealed that R-appliance can successfully improve the dentoskeletal of patients with mandibular deficiency.

Regarding the skeletal changes, R-appliance results showed restricting impact on the forward growth of the upper jaw during treatment of Class II division 1 due to mandibular retraction, this was confirmed by non-significant increase of maxillary length and SNA angle. The result of the SNB angle was highly significant increased due to anterior movement of the mandible and decreased ANB angle; Result of ANB angle was increased due to forward movement of mandible and restricted of maxillary growth. This result showed also that the length of the mandible was a highly significant increased due to anterior movement of the mandible after treatment by R- appliance.

Regarding the vertical dimension the present study showed significant increased with liners**- S - GO, N – Me, Ans –Me** by 4.9, 5.09, 3.7 mm respectively, they could be due to increase ramus height of the mandible and downward – forward of the mandible.

The results of dentoalveolar changes were highly significant decreased with overjet due to skeletal change and change position of U1\SN angle that was decreased also significant increase of U1\L1 angle due to lip musculature pressure during mandibular closing produce extreme retracting force on the maxillary incisors resulting palatal tipping. Regarding lower incisors position in Class II correction with functional appliances represent critical position and should be restricted, thus after R- appliance treatment position of lower incisor was not proclained due to lack reaction of retractor muscles of the mandible, which led to a slightly decrease of the lower incisors proclination, in additionally design of the appliance by incorporating lingual bar that prevented any force on the lingual surface of the lower incisors; Thus, this was suggested to more of skeletal changes than dentoalveloar changes. The dentoalveolar changes in this study showed that the (U1–PP) was significantly increased, this increase was due to slightly retroclination of the upper anterior teeth as a result effect of the upper lip musculature pressure. Regarding the position of mandibular first molar in relation to mandibular plan (L6 – MP), the results of the present study showed that it was significantly decreased. This result was due to the full time wearing of the appliance that led to intrusion of the mandibular first molars. Thus, this disadvantage contributed to the appearance of the temporary open bite posteriorly. On the other hands, (L1– MP, U6 – PP) lines were not significantly increased

Based on the data of present study we can conclude that R - appliance was successful in improving of skeletal, dentoalveolar discrepancy, and could be used in treatment of class II division 1 due to mandibular deficiency. Additionally, the appliance influences on growth potential of the mandible was evidenced by increasing growth of the mandibular base and mandibular length. R- appliance has an advantage over most functional appliances as it could be used in patient with proclined lower incisors. However, more studies with a longer period of follow-up, and a large sample must be required to prove results of the present study

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