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POSTERIOR TRANSVERSE CHANGES IN THE DENTAL ARCH FOLLOWING MAXILLARY MOLAR DISTALIZATION IN CLASS II MALOCCLUSION

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ABSTRACT

Objective: The present study was conducted to evaluate posterior transverse changes of the maxillary dental arch in class II malocclusion accompanying maxillary molars distalization.

Materials & methods: Twelve subjects with a mean age of 19.4 years, moderate skeletal class II malocclusion, dental class II molar relationship, and full permanent dentition participated in this study. Dental Cone Beam Computed Tomography scans (CBCT) were done before and immediately after distalization. Maxillary posterior segment was prepared for molar distalization by leveling and alignment till reaching stiff stainless steel arch wire. A miniscrew was inserted mesial to the maxillary permanent first molar and immediately loaded; and open coil spring was placed between maxillary second premolar and first permanent molar.

Results: The maxillary second premolar moved buccally significantly by a mean of 2.01 mm; while the maxillary first and second molars showed highly significant buccal movement following distalization by means of 1.43 mm and 0.95 mm respectively.

Conclusion: From the results obtained from this study, it could be concluded that using open coil spring and miniscrew as indirect anchor age during maxillary molars distalization; produces buccal expansion of maxillary dental arch.

KEY WORDS: Maxillary molar distalization, temporary anchorage device, dental arch transverse changes.

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INTRODUCTION

The original definition of Class II malocclusion was introduced by **Angle** in **(1899)**. It was based on the position of the first permanent molars. This distal relationship between the first permanent molars could be due to a skeletal Class II jaw relationship, maxillary dentoalveolar protrusion, mesial rotation of the maxillary first permanent molars, or a combination of all of these factors.[1] Consequently, class II malocclusion comprises subjects with a very wide range of dentofacial features, which must be recognized in the orthodontic diagnosis and problem lists, treatment objectives, and treatment plans.

Due to the paradigm shift from focusing on the dentition to appraising the whole face; non-extraction treatment has become popular for correction of class II malocclusion,[1] and often requires distalization of maxillary molars into class I relationship.[2]

Maxillary molar distalization is indicated for a class II dental relationship, minor to moderate skeletal class II relationship and mild, or no mandibular tooth size – arch length discrepancy. It is contra indicated in protrusive profiles with severe incisors proclination, anterior open bites, significant crowding, and high mandibular plane angle.[3]

Molar distalization by traditional appliances such as extraoral traction, Cetlin removable plate, and Wilson distalzing arches; requires patient cooperation.[4] Intraoral non-compliance appliances for maxillary molars distalization such as push coils[5,6], magnets[7,8], Pendulum[9,10,11], Jones jig[2,12,13], Distal Jet[14,15], and First Class Appliance;[16] do not need extensive patient cooperation.

All these techniques are effective to distalize both maxillary permanent first and second molars but may cause anchorage loss in the form of maxillary incisor protrusion and increased overjet.[17]These unwanted tooth movements have to be corrected in a subsequent stage (round tripping).

Improvements of temporary anchorage devices have enhanced their use for orthodontic patients.[17,18,19,20] Since the time of their introduction, they were used to provide stable anchorage for different tooth movements.

The main problem in distalization was, and is still, anchorage loss when using traditional anchorage means during the treatment. To avoid this problem, anchorage can be provided by temporary anchorage devices that offer ultimate anchorage and almost absence of anchorage loss when inserted accurately.[21]

MATERIAL AND METHODS

This study was approved by the ethical committee at the Faculty of Dentistry, Ain-Shams University*. All subjects were randomly selected from the outpatient clinic of the Orthodontic Department, Faculty of Dentistry, Ain-Shams University. All patients had been informed about the purpose of the study and possible complications; and signed a consent form.

All patients met the following inclusion criteria: (1) age ranging from 18 to 25 years; (2) moderate skeletal class II malocclusion; (3) dental class II molar relationship; (4) full permanent dentition, with exclusion of third molars; (5) mild to moderate crowding in the upper dental arch, and / or increased overjet; and (6) normal or horizontal growth pattern.

The exclusion criteria were: (1) Previous orthodontic treatment; (2) surgical treatment plan; (3) extraction treatment plan; (4) Severe molar rotation; and (5) Poor oral hygiene.

Full set of orthodontic records were taken for every subject. The maxillary first and second molars were banded; and the maxillary first and second premolars were bonded. Then, these teeth were levelled and aligned till reaching stiff stainless steel arch wire. Temporary anchorage device

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(1.8 mm diameter,8 mm length) was inserted in the inter- radicular area buccally, between the maxillary second premolar and the maxillary first molar.[22,23,24,25]) Then, the miniscrew was tied to the maxillary first premolar with stainless steel ligature wire. An open coil spring was inserted between the maxillary second premolar and the maxillary first molar; with a force 300 gm;[26,27] as shown in figure (1). The maxillary first molar was distalized till achieving overcorrected class I molar relationship.

Fig. (1) Distalization system in place

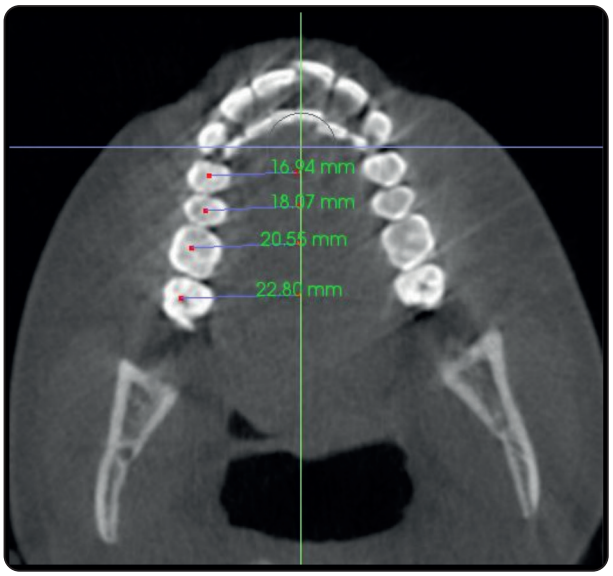

Fig. (2): (A) The distance from the center of occlusal surface of the upper first premolar to the midsagittal plane, (B) The distance from the center of occlusal surface of the upper second premolar to the midsagittal plane, (C) The distance from the center of occlusal surface of the upper first permanent molar to the midsagittal plane, (D) The distance from the center of occlusal surface of the upper second permanent molar to the midsagittal plane.

CBCT Measurements

For each patient enrolled in the study, pre- and post-treatment Cone Beam Computed Tomography (CBCT) were taken; to measure the transverse movement as shown in figure (2); and according to the following parameters:

1. U4 transverse movement: the distance from center of occlusal surface of the upper first premolar to the midsagittal plane.
2. U5 transverse movement: the distance from center of occlusal surface of the upper second premolar to the midsagittal plane.
3. U6 transverse movement: the distance from center of occlusal surface of the upper first permanent molar to the midsagittal plane.
4. U7 transverse movement: the distance from center of occlusal surface of the upper second permanent molar to the midsagittal plane.

RESULTS

Pretreatment records, post treatment records, and difference between them regarding transverse – linear - dental measurements; were presented in table (1).

Comparison between pretreatment & post treatment records was performed; by using Paired t-test which revealed significant difference between them in all measurements as (P-value <0.05); except U4 as there was insignificant difference between pre & post as (P-value > 0.05). In U5, there was a statistically significant difference as (P-value <0.05) [pre was significantly lower than post]; while in U6 and U7 there was a highly statistically significant difference as (P-value < 0.001) [pre was significantly lower than post].

TABLE (1): Mean & standard deviation of pretreatment, post treatment records and difference between them regarding transverse - linear dental measurements:

Transverse Linear Dental Measurements	Pre		Post		Difference		P value
	M	SD	M	SD	MD	SD	
U4	16.80	2.01	18.55	2.03	1.75	1.36	0.438
U5	18.83	2.06	20.84	1.94	2.01	1.11	0.001*
U6	21.96	2.21	23.39	2.06	1.43	0.98	0.000**
U7	24.50	2.55	25.45	2.50	0.95	1.01	0.000**

M: mean SD: standard deviation MD: mean difference
P: probability level which is significant at P-value ≤ 0.05

DISCUSSION

Class II malocclusions may be corrected by one, or combinations of: (1) restriction or redirection of maxillary growth; or (2) enhancement or redirection of mandibular growth in adolescents; (3) distal movement of the maxillary dentition; (4) mesial movement of the mandibular dentition; (5) derotation of maxillary first permanent molars; (6) extraction; or (7) surgery in adult with skeletal problem.[28]

Maxillary molar distalization is intended to gain or restore space for the teeth in the arch.[29] Several treatment modalities are available for the distal movement of the maxillary molars. These can be achieved with either intraoral or extraoral, inter-arch or intra-arch and fixed or removable appliances.[30]

Regarding the transverse changes in the present study, the maxillary first and second molars moved in the buccal direction significantly. Similar molar buccal movement was observed in previous studies such as that by **Kircali** and **Yüksel**[11] and others [9,12,14,15,16]. This was opposite to what published by **Mavropoulos et al.**[13] and **Abdelhady et al.**[19]. The increase in the transverse width at the maxillary molars region; was due to their distal movement into a wider part of the arch. Also, this could be attributed to molar rotation with buccally applied force. This increase in width is necessary to maintain proper transverse relationship of the maxillary and mandibular molars during distalization.

The transverse arch dimensions at the premolar region increased due to their buccal movements; as shown in the findings of other studies such as that of **Bolla et al**[14], **Ghosh** and **Nanda**[9], **Mavropoulos et al.**[13], and **Abdelhady et al.**[19]. This can be explained by the distobuccal rotation of the premolars.

CONCLUSIONS

Maxillary molars distalization using miniscrew and open coil spring system, produced buccal movement of maxillary premolars and molars.

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