



Original Article

Evaluation of Dentoskeletal and Profile Changes with Distal Jet in Moderate Skeletal Class II Patients

Asia Khalid¹ and Zubair Hassan Awaisi¹¹Department of Orthodontics, Nishtar Institute of Dentistry, Multan, Pakistan

ARTICLE INFO

Key Words:

Malocclusion, Angle's Class II, Distalization, Cephalometry, Distal Jet

How to Cite:

Khalid, A. ., & Hassan Awaisi, Z. . (2023). Evaluation of Dentoskeletal and Profile Changes with Distal Jet in Moderate Skeletal Class II Patients: Dentoskeletal and Profile Changes with Distal Jet. *Pakistan Journal of Health Sciences*, 4(06).
<https://doi.org/10.54393/pjhs.v4i06.741>

***Corresponding Author:**

Asia Khalid
 Department of Orthodontics, Nishtar Institute of Dentistry, Multan, Pakistan
asidr01@gmail.com

Received Date: 4th May, 2023Acceptance Date: 25th June, 2023Published Date: 30th June, 2023

ABSTRACT

In an orthodontic treatment, upper molar distalization is mandatory to gain space in upper arch. **Objective:** To evaluate the nature of molar distalization & its effects on soft tissue profile, dentoalveolar structures & skeletal structures. **Methods:** This was a retrospective study design. 20 subjects were found to be eligible for the distalization with average age of 19.4 yrs. Only Distal jet was used for distalization and one operator was there for all the subjects. Pre and post treatment cephalograms were taken to analyze dentoalveolar & soft tissue changes. Paired sample T test was used. **Results:** Notable amount of molar distalization and increased lower face height was achieved. **Conclusions:** This study verified definite distalization of maxillary first molars using distal jet showing a better bodily movement with less tipping movement, with certain unwanted & reactionary effects on incisor position & limited effects on facial soft tissues.

INTRODUCTION

In orthodontic practice today one of the most commonly presented problems is the class II malocclusion. Advancements in chemo-mechanical therapies, treatment approaches and new theories and principles have minimized the demands of extractions in mild to moderate discrepancies [1]. Class II malocclusions which are characterized by only dental component with no skeletal component, the non-extraction treatment often requires distal movement of maxillary molars into class I relationship. Maxillary molars can be derived distally by force systems that require patient cooperation e.g., headgear, Wilson maxillary biometric distalizing arch etc., while systems which requires less patient cooperation can lead to predictable results. Many of the intraoral appliances

claimed to minimize the need of patient compliance such as Magnets, super elastic nickel-titanium wires, Jones Jigs, Pendulum, First Class and Distal Jet [2, 7]. Distal jet is intraoral, palatally placed maxillary molar distalization appliance. Conventional distal jet appliance consists of nickel-titanium (Ni-Ti) open coil spring, the banded upper first molars, banded upper first premolars and the Nance button on palate. It works by the compression of Ni-Ti spring between first molars and first premolars which are banded [8]. Intraoral appliances offer the advantage of no patient dependency however, with most of these methods the commo disadvantage is the unwanted ,un necessary anchorage loss in the premolars and incisors during distalization phase. In addition, molar tipping is also

frequently seen. No Doubt the fixed distalizing appliances do not need any compliance from patient however, a reactionary force is produced on anterior teeth which results into anchorage loss [8]. Moreover, at the end of distalization phase, further anchorage loss may occur during retraction phase which prolongs the treatment [9]. The distaljet appliance was designed in such a way that the forces are directed to pass through the center of resistance of upper first molars. The teeth if are bracketed during the phase of distalization, there will be less tipping as compared to other intraoral appliances such as the pendulum, Jones jig, Greenfield molar distalizing appliance [10]. The idea behind this retrospective clinical study was to check out the type of maxillary molars distal movement using distal jet appliance whereas secondary goal was to identify its effects on incisors position and facial soft tissue.

METHODS

In this retrospective study design, 40 cases were studied and 20 subjects (08 males, 12 females) were found to be eligible for the study. The lateral cephalograms were taken at two different stages, T_0 and T_1 , pre distalization and post distalization respectively. Average duration of distalization phase was 7.8 months, with a range of 6-11 months. The cephalometric drawing was made on Acetate Matte sheets. Two lateral cephalograms were compared by taking same linear and same angular measurements at T_0 and T_1 . All cephalometric drawings were made and assessed by the same examiner. All the data were analyzed in SPSS statistical software. The sample was collected fulfilling the following inclusion criteria: untreated dental class II malocclusion subjects, moderate skeletal class II, all permanent teeth, no severe mandibular crowding and normal mandibular plane angle. All patients in the study were given same treatment by distal jet appliance which is intraoral, palatally positioned, non-dependency appliance to gain space as a part of non-extraction treatment approach. Bands were placed on maxillary first premolars and first molars. Distal jet was placed as a single unit and cemented by Glass Ionomer Cement. Appliance was activated bilaterally, sliding the collar distally to compress Ni-Ti open coil spring. The appliance was activated at same pattern once in a month. Molar distalizing appliance was used until the molar relation was over corrected up to super class I [3]. Later on, distal jet was converted into nance holding appliance after the completion of distalization phase (Figure 1).



Figure 1: Pre and post distalization

A transparent sheet of Acetate Matte was pasted on the lateral cephalogram, anatomic landmarks were marked. A perpendicular line dropped to the sella-nasion plane through intersection of anterior wall of sella turcica and anterior clinoid process to make vertical reference plane. These structures were taken because they do not change with growth changes. To quantify the distal movement, lines drawn from central incisors, premolars, and molars perpendicular to vertical reference line (Figure 2). The difference of T_0 and T_1 measurements showed the actual amount of distalization for each tooth.

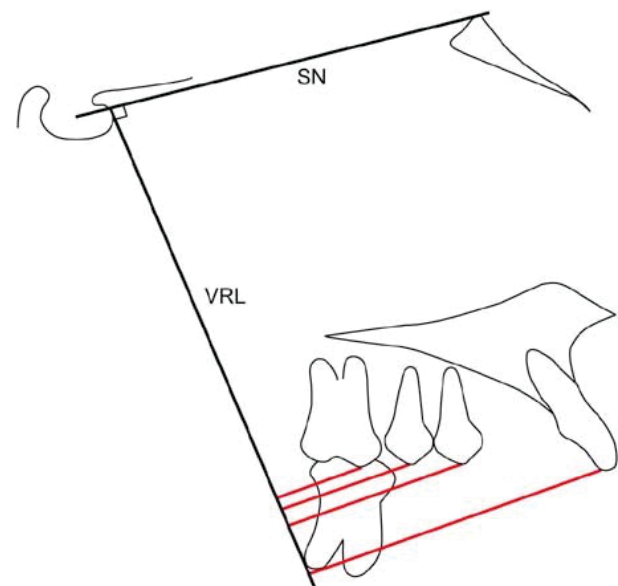


Figure 2: Cephalometric tracing and measurements. SN: sella nasion line, VRL: vertical reference line. Red lines: distalization amounts of the central incisor, premolar and molar teeth

Pretreatment and post-distalization lateral cephalograms were compared by taking some linear and some angular measurements as follows [1]: 1. Upper lip to E line distance (mm). 2. Lower lip to E line distance (mm). 3. Nasolabial angle. 4. Lower face height (mm). 5. Distance of incisor tip from VRL (mm). 6. Distance of first premolar from VRL (mm). 7. Distance of second premolar from VRL (mm). 8. Distance of first molar from VRL (mm). Descriptive statistics, i.e., mean and standard deviation of all the variables pre and post distalization were analyzed. Paired-sample T test was used.

RESULTS

In this retrospective study, using lateral cephalogram of 20 subjects it was revealed that significant molar distalization ($p < 0.005$) was achieved by using distal jet as distalization appliance whereas the changes in the Lower Face Height were also found to be remarkable ($p < 0.005$). The changes in position of upper and lower lips remained insignificant (Table1).

Table 1: Comparison of Pre and post distalization changes by paired sample T test

Variables	Mean ± SD	p-value
Pair 1 ULE_t0 - ULE_t1	.200±1.239	.479
Pair 2 LLE_t0 - LLE_t1	-.250±1.118	.330
Pair 3 NLA_t0 - NLA_t1	2.10±7.959	.253
Pair 4 LFH_t0 - LFH_t1	-3.65±2.777	.000**
Pair 5 D1_t0 - D1_t1	-1.20000	.176
Pair 6 D4_t0 - D4_t1	-1.30000	.097
Pair 7 D5_t0 - D5_t1	-.30000	.826
Pair 8 D6_t0 - D6_t1	2.45000	.003**

**Statistically significant

The value of nasolabial angle showed no changes. The central incisors, first and second premolars showed slight mesial tipping but not significant. Table 2 shows the sample of 20 had more female subjects which means the females are more conscious about their dentition and are more likely to get dental treatment.

Table 2: Gender distribution

Variables	Frequency (%)
Male	8(40.0)
Female	12(60.0)
Total	20(100.0)

DISCUSSION

In orthodontic treatment success, patient cooperation is the most important factor. However it is also been noticed that the patient compliance with the intraoral and extraoral removable appliances like headgear, interarch elastics is unpredictable. In view to that many fixed intraoral distalizing appliances are launched to reduce the limitation of patient compliance to gain maximum results. Many fixed intraoral appliances as follows: Magnets, super elastic nickel-titanium wires, Jones Jigs, Pendulum, First Class and Distal Jet. Although these appliances are independent of patient compliance, there are some disadvantages in the form of unwanted treatment outcomes like upper molar distal tipping and anchorage loss during the phase of molar distalization up to molar relation super class 1. Among these appliances distal jet has some clear advantages. Esthetic, comfortable, less molar tipping and less palatal displacement (Figure 2) of molars during distalization and same appliance can be readily altered into nance appliance as a stabilizing appliance to the molars into their current distalized position [11]. This study of 20 subjects, revealed

no appreciable changes in the position of upper and lower lips after distalization nor the p-value of Nasolabial angle showed significant changes, however the Lower face height was significantly increased. Usually the use of distal jet appliance is associated with some unfavorable or unwanted effects, distal tipping of molars and mesial tipping of premolars and incisors. This also happened in our study but it was so negligible that the values became insignificant. Anchorage maintenance is very crucial during upper molar distalization. The anchorage plan in this study consisted of bands on first premolars with the use of large acrylic nance palatal button to dissipate reciprocal anterior forces originated from activated coil springs, over a broad palatal area. The alterations in the incisor position distinctly shows that this anchorage system cannot resist completely, the reciprocal anterior force produced as a consequence of activation of distal jet still it was good enough that anchorage loss was minimal. Skeletal anchorage system is the recent advancement in orthodontic treatment techniques over the past 10 years. In a study conducted by Yamada *et al.*, upper molars were distalized by mini-implants inserted in between second premolar and first molar [12]. Though molars were displaced distally just by 2.8 mm with distal tipping of 4.8°, but the incisors actually moved distally and there appeared palatal tipping contrary to our study. In a recent study, posterior molar movement was carried out by using zygoma gear appliance, comprised of zygomatic anchorage miniplate [13]. Molar appeared to be distalized by 4.37 mm, quite less tipping of 3.3° and molars showed intrusions as well. Other significant finding was lingual tipping and a reduced overjet, recommending that there was no anchorage loss. Much close and related results were seen in another study by Kilkis *et al.*, where the zygoma gear appliance was used for unilateral distalization [13]. For a Molar relation to be corrected or crowding to be relieved the frequent mechanotherapy is the distalization using different appliances. According to study conducted by Nalcaci *et al.*, superimpositions of study model photographs, serial cephalometric radiographs and photocopies were used and pre and post treatment changes were compared for the assessment of the efficacy of different appliances [14]. The results were found to be significant. In another study, Vilanova *et al.*, compared the treatment changes by distal jet and Jones jig. Clockwise rotation of occlusal plane and mesial tipping of maxillary second molars were found to be in both the groups [15]. The molar distalization success is dependent upon two main factors: First is type of movement and second is the timing of treatment. It is being debatable that when the second molar has not yet erupted, first molar distalization takes place by tipping rather than by bodily movement. Molars

can be distalized at any age but the best and advantageous time is late mixed dentition period [16]. Many case reports and studies depicted the results of using different appliances for molar distalization, anchorage loss and tipping of maxillary incisors remained common and significant amount of relapse was also there during the retraction phase [17]. In our study, significant amount of molar distalization was seen along with the minimum anchorage loss. With the passage of time advancements in treatment methods and mechanics allow us to move maxillary molars posteriorly in an adult with the help of skeletal anchorage system. The recorded amount of distalization was 3.78 mm at the crown level and 3.20 mm at the root level [18]. But in our study the average distalization of 2.3mm was recorded using a conventional distal jet appliance. The use of midpalatal mini screws as skeletal anchorage system is a recent advancement and it serves many advantages like less failure rate and help in reaching optimal treatment goals. The midpalatal area is the best anatomical area for placing a mini screw because it does not have large vessels and nerves and roots of the teeth which often cause mini screw failure. According to study conducted by Mah *et al.*, reveals bodily distal movement with a mean distal movement of 2.4 mm which is so close to our study results [19]. As far as duration of treatment is concerned, it was also found to be increased, when second molars have erupted, hence distalization is often recommended before the eruption of the full permanent dentition [20]. The study was of retrospective design, could be argued that selection bias was present, and lack of cephalometric variables that evaluate mandibular growth.

CONCLUSIONS

Based on this cephalometric study, it was concluded that significant amount of molar distalization was done using distal jet appliance with minor elements of anchorage loss. Leaving minimal impact on facial soft tissues except for the lower facial height which was significantly increased.

Authors Contribution

Conceptualization: AK, ZHA

Methodology: AK

Formal analysis: AK

Writing-review and editing: AK, ZHA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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