Case Report: Modified use of the Jasper Jumper appliance in a skeletal Class II mixed dentition case requiring palatal expansion

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The Jasper Jumper (American Orthodontics, Sheboygan, Wisc), developed by Dr. James Jasper, is a fixed functional appliance that is designed to deliver light, continuous force to correct Class II malocclusion.[1] It is purportedly capable of producing effects similar to those of headgear, activator, or a combination of the two, depending on how it is activated (American Orthodontics product brochure). The Jasper Jumper is also capable of moving single teeth, groups of teeth, or an entire arch.[1] Functionally, it has an advantage over other fixed functional appliances, such as the Herbst, in that it is flexible, allows more lateral freedom of the mandible, and is easier for the patient to maintain.

Cope et al.[2] reported that the hypothesized mechanism for Class II correction by the Jasper Jumper is as follows: basal restraint of the maxilla, dentoalveolar retraction of the maxillary dentition, increased growth at the mandibular condyle, downward and forward remodeling of the glenoid fossa, and lateral expansion of the maxillary molars. Results of their study indicated that Class II correction using a Jasper Jumper occurred mainly through dentoalveolar movement and secondarily through restraint of maxillary growth. Furthermore, they reported that the mandible tended to rotate clockwise and showed little or no horizontal growth.

At present, the literature does not include a description of a method for use of the Jasper Jumper in a case that is not concurrently undergoing fixed edgewise therapy. The purpose of this report is to describe a modification of the "classic" use of the Jasper Jumper for application

Abstract

The Jasper Jumper appliance provides a method of Class II correction with an active force component that the patient cannot remove. A modification of classic Jasper Jumper usage is illustrated in a mixed dentition case where full banding is impractical. This report shows how Jasper Jumper springs can be attached to a fixed maxillary expansion appliance and a lower lingual holding arch for correction of a Class II malocclusion. Cephalometric analysis revealed that despite seemingly adequate anchorage for the springs, treatment changes were largely dentoalveolar, with minimal improvement in the underlying skeletal structures. Some restraint of maxillary growth was found, but most of the overjet correction was due to forward movement of the mandibular dentoalveolar complex and retraction of the maxillary dentoalveolar complex.

Key Words

Jasper Jumper • Skeletal Class II • Palatal expansion

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Figure 1A

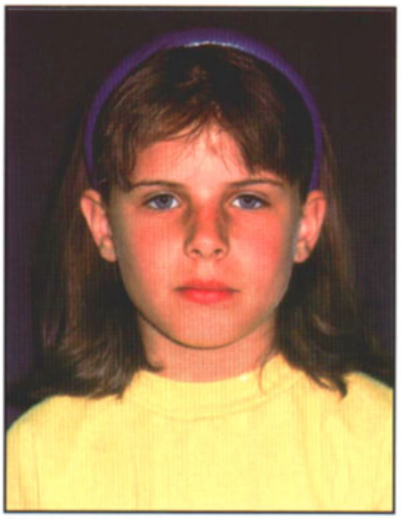

Figure 1B

Figure 1A-C
Pretreatment profile, frontal, and anterior intraoral views of patient J.S., 9 years 6 months.

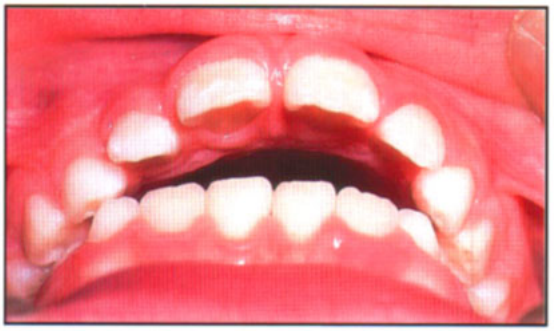

Figure 1C

Figure 2A-B
Pretreatment lateral cephalometric headfilm and computer-generated digital cephalometric plot showing the pretreatment values.

Figure 2A

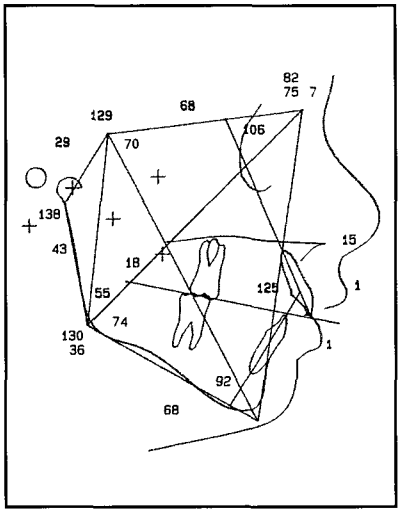

Figure 2B

in an early mixed dentition case requiring habit modification and palatal expansion as well as overjet correction.

Case report

J.S., a 9-year 1-month-old female, presented for correction of a skeletal Class II malocclusion characterized by an anterior openbite due to an active finger-sucking habit. Pretreatment examination (Figure 1A-C) revealed a mixed dentition stage of development with minor mandibular incisor crowding and some excess space in the maxillary incisor area.

The molar relationship was full cusp Class II on the left side and end-to-end Class II on the right. The maxillary incisors were protrusive and the mandibular incisors were somewhat upright in appearance. An anterior openbite of approximately 2.0 mm was noted, and the overjet was measured at approximately 9.0 mm. The midlines were coincident.

The profile photograph (Figure 1A) shows a convex facial profile with an orthognathic maxilla and a retrognathic mandible. Lower facial height was judged excessive, while lip line, upper lip length, and nasolabial angle were all considered normal. Skeletal analysis, as obtained by cephalometric assessment of the patient's lateral headfilm, showed a skeletal Class II facial pattern with an ANB angle of 7.2 degrees (Figure 2A-B).

Treatment objectives for patient J.S. were as follows:

1. Achieve a Class 1 molar relationship;
2. Decrease the overjet;
3. Close the openbite;
4. Eliminate the active thumb-sucking habit;
5. Reduce the skeletal disharmony; and
6. Improve the facial profile.

In order to achieve these objectives, Class II fixed functional therapy was undertaken. Molar intrusion from the Jasper Jumper springs was expected to help close the anterior openbite. Maxillary widening by means of a midpalatal expansion screw was planned in order to coordinate the transverse dimensions of the maxillary and mandibular arches.

Treatment plan

Molar bands were adapted to the patient's permanent first molars and deciduous second molars in both arches. Alginate impressions were taken and maxillary and mandibular metal frameworks created (Figure 3A-B).

A maxillary rapid palatal expansion device was soldered to the four maxillary molar bands. A bar soldered to the buccal aspect of the band on the deciduous lower second molars clipped into the bracket slots on the permanent first molars (Figure 3C). This allowed for ease of insertion of the Jasper Jumpers and quick removal of the springs, as required.

Jasper Jumper springs were secured to the maxillary appliance by means of a ball pin attachment placed through each of the headgear tubes on the maxillary first molar bands (Figure 3C,

arrow A). The ball pin attachment extended 2 to 3 mm distal to the distal aspect of the headgear tube to allow "free play" of the Jumper. The ball pin was bent upward mesial to the headgear tube to prevent the pin from slipping distally out of the tube.

Finally, the springs were secured to the mandibular arch by slipping the central hole of the metal plate onto the distal aspect of the buccal bar. The extent to which the Jumper could slide mesially was restricted by placement of a Teflon ball on the buccal bar (Figure 3C; arrow B), and distally by the terminal bend of the buccal bar as it ascended to snap into the bracket slot of the mandibular first molar band (arrow C). The distal aspect of the buccal bar was secured to the mandibular molars on each side by a single elastomeric ligature around the wings of the bracket (arrow D).

Course of treatment

The appliance, without Jasper Jumper springs, was cemented in place and the patient was instructed to turn the maxillary expansion screw one turn per week. One month later, the Jasper Jumper springs were inserted. Springs measuring 32 mm (size #4) were used on both the right and left sides.

Because of the still-active thumb-sucking habit, the maxillary portion of the appliance was modified by adding bilateral fork-like extensions from the mesial solder joint. The extensions effectively blocked the thumb from making contact with the palate.

The patient was seen regularly at 4-week intervals, and the overjet decreased at a rate of approximately 1 mm per month. Within 2 months, the anterior openbite was closed and the patient had completely stopped sucking her thumb.

Crimpable stops were added to the buccal bar on two occasions. These stops were placed 2 months after insertion of the Jumper springs, and again at 3 months (Figure 4). This allowed for easy reactivation of the springs without having to replace them. Each stop allowed 2 mm of additional activation by compression of the springs.

Approximately 5 months into the active treatment, the size #4 (32 mm) springs were removed and replaced with size #5 (34 mm).

Within 6 months of active treatment, the overjet had been reduced from 9 mm to approximately 1 mm. After correction of the overjet, the springs were left in place without further activation for an additional 4 months to achieve some overcorrection of the overjet and to allow some time for muscle adaptation to the altered

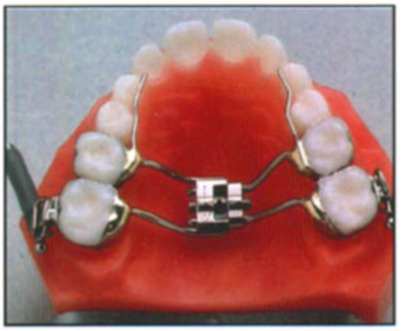

Figure 3A

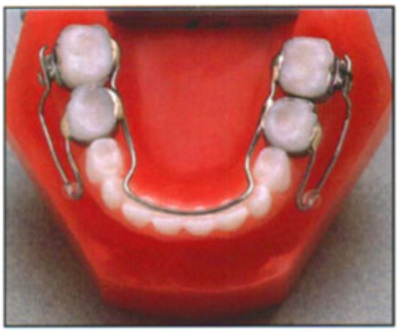

Figure 3B

Figure 3A-B
A-B: Mixed dentition adaptation of Jasper Jumper appliance. Maxillary framework includes expansion screw; mandibular framework includes lingual arch and buccal bars.

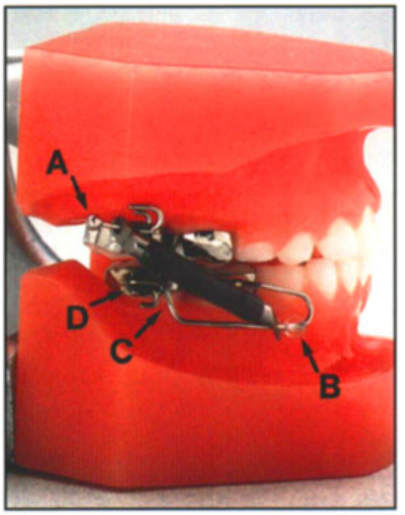

Figure 3C

Figure 4

Figure 5A

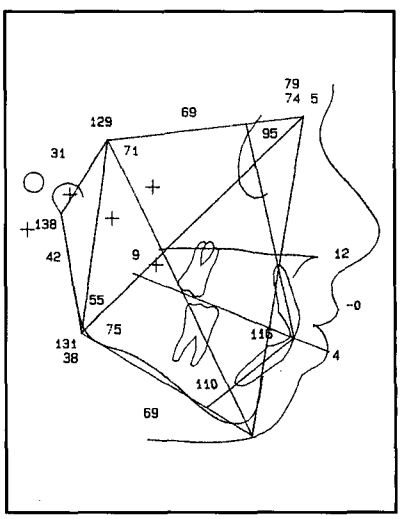

Figure 5B

Figure 3C
C: Buccal view showing (A) ball pin attachment used to ligate spring to maxillary arch, (B) teflon ball used to limit mesial movement of spring on buccal bar, (C) bend placed in mandibular buccal bar to allow ligation of bar to mandibular first molar, and (D) elastomeric ligature placed to secure buccal bar into lower molar bracket slot.

Figure 4
Arrow indicates crimpable stops used for reactivation of springs.

Figure 5A-B
Immediate posttreatment cephalometric headfilm and computer-generated cephalometric plot showing immediate posttreatment cephalometric values.

Figure 6A

Figure 6B

Figure 6A-B
Profile and frontal views of patient J.S. 6 months after removal of Jasper Jumper, age 10 years 10 months.

Figure 7

Figure 7
Left buccal view 2 months posttreatment.

skeletal and dental relationships.

After a total of 10 months of Jasper Jumper treatment, the appliances were removed. At the time of removal, the patient's dentition was overcorrected with overjet and overbite equal to 0 mm and 0%. Upon completion of the cephalometric analysis (Figure 5A-B), the ANB angle was noted to have decreased slightly from the original value. A set of facial and intraoral photographs was taken 2 months after appliance removal (Figures 6 and 7). Some settling of the occlusion had occurred in this time period, resulting in an improved overjet and overbite relationship.

Six months after the appliance was removed, the overjet had increased to 3 mm and the overbite was 25%. A third cephalometric film was taken to assess the extent of relapse during the 6-month follow-up period. A comparison of the cephalometric measurements before treatment, at the end of the appliance phase, and 6 months after appliance removal is shown in Table 1. Cephalometric tracings have been superimposed to illustrate treatment effects and relapse tendencies (Figure 8A-C).

Description of custom analysis

The custom analysis (Figure 9) used in this study was modeled after those used by Pancherz, Cope and May.[2-4] In the present study, computer software (Dentofacial Software Inc, Toronto, Ontario, Canada) was used to design an analysis that used sella-nasion as the reference plane for superimposition. A series of horizontal measurements was made from various landmarks to a reference plane that extended from sella perpendicular to the palatal plane. All horizontal measurements were made in millimeters from the cephalometric landmarks to the reference perpendicular. All vertical changes were measured in millimeters perpendicular to either the mandibular or palatal plane.

The goal of this analysis was to provide a simple way of assessing skeletal and dental changes due to treatment. Skeletal change was assessed by comparing the relevant horizontal movement of the following cephalometric landmarks during treatment: condylion, articulare, A-point, and B-point. Dental change was assessed by comparing the relative horizontal and vertical changes of the following landmarks: maxillary and mandibular first molar (mesial cusp tip), and maxillary and mandibular central incisor (incisal tip). The anteroposterior skeletal discrepancy was measured by calculating the horizontal distance between A-point and B-point. Incisor and molar overjets were measured by calculating the horizontal distance between the maxillary and mandibular incisor points and the corresponding molar points.

Results and discussion

Data derived from cephalometric investigation of initial and posttreatment lateral headfilms indicate that, while significant movement of the dentoalveolar complexes occurred, the skeletal bases changed only slightly (Table 1).

The ANB angle decreased by 1.7 degrees, indicating that the Jasper Jumper mechanics did cause some skeletal change. Cope et al.[2] reported that the Jasper Jumper not only acts to restrain the maxilla, but is actually capable of displacing the maxilla backward ("headgear effect"). This was the case in patient J.S., as evidenced by the 2.8-degree decrease in SNA angle.

The slight reduction in angle SNB (-1.1 degrees) during treatment may be attributable to a clockwise rotation of the mandible. This finding is also in accordance with the results found in the study by Cope et al.[2]

The SN-GoGn angle increased by 1.6 degrees. This finding was quite surprising, because clini-

cally, it appeared that the Jasper Jumper appliance was intruding both the maxillary and mandibular molars to close the anterior openbite. The maxillary molars were intruded by 4.2 mm. However, the mandibular molars were actually extruded 1.3 mm by the appliance. This may have contributed to the slight clockwise rotation of the mandible and concurrent increase in the SN-GoGn angle. This result is similar to the data reported by Cope et al.,[2] indicating that the maxillary molars have a tendency to intrude while the mandibular molars tend to extrude with Jasper Jumper treatment.

In addition to vertical movements, the mandibular molars also moved forward by 5.5 mm, and the maxillary molars moved distally by 3.0 mm. This finding concurs with similar effects noted by Cope et al.[2]

The maxillary incisors, even with no brackets or archwires touching them, underwent 10.9 degrees of uprighting in relation to SN, while the mandibular incisors tended to procline. In this study, the angle of lower incisor to GoGn increased by 18.3 degrees. This represents a significant amount of tipping, which, when added to the maxillary incisor movements, seems to account for most of the reduction of the excessive overjet. It was also found that the angle formed by the occlusal plane to GoGn decreased by 8.8 degrees. This resulted from the mandibular incisors being intruded as well as tipped anteriorly. Again, this was similar to the results reported by Cope et al.[2] It was also found that the interincisal angle decreased from 125.2 degrees to 116.3 degrees through the course of Jasper Jumper therapy.

A follow-up cephalogram was taken 6 months after removal of the Jasper Jumper in order to assess relapse. Superimposition of this final cephalometric tracing with the tracing on the immediate posttreatment cephalogram indicates that some favorable relapse has occurred (Figure 8A-C). In particular, the labially proclined mandibular incisors uprighted lingually by 8.6 degrees following removal of the Jasper Jumper.

In addition, the distally tipped maxillary molars migrated forward 2.9 mm in the 6-month posttreatment period. The maxillary incisors, which had been uprighted lingually by 10.9 degrees during treatment, rebounded labially by 4.7 degrees after treatment.

Conclusions

The Jasper Jumper can be used in the mixed dentition to achieve rapid correction of a Class II openbite malocclusion. Furthermore, the appliance can be modified to include palatal expansion and correction of a digit-sucking habit using a rigid framework design that does not require full-arch bonding and use of archwires.

Similar to results seen in the permanent dentition, as reported by Cope et al.,[2] the Jasper Jumper appliance in this mixed dentition case resulted in significantly more dentoalveolar movement than skeletal correction. Dentoalveolar movement may be broken down into molar and incisor components.

The maxillary molars tended to tip distally and intrude, while the mandibular molars tended to move mesially and extrude.

The mandibular incisors tended to procline labially and intrude, while the maxillary incisors tended to upright lingually and extrude.

Overall, some restraint of the maxilla may have occurred. In addition, unfavorable clockwise rotation of the mandible took place.

Although we hoped that the rigid framework

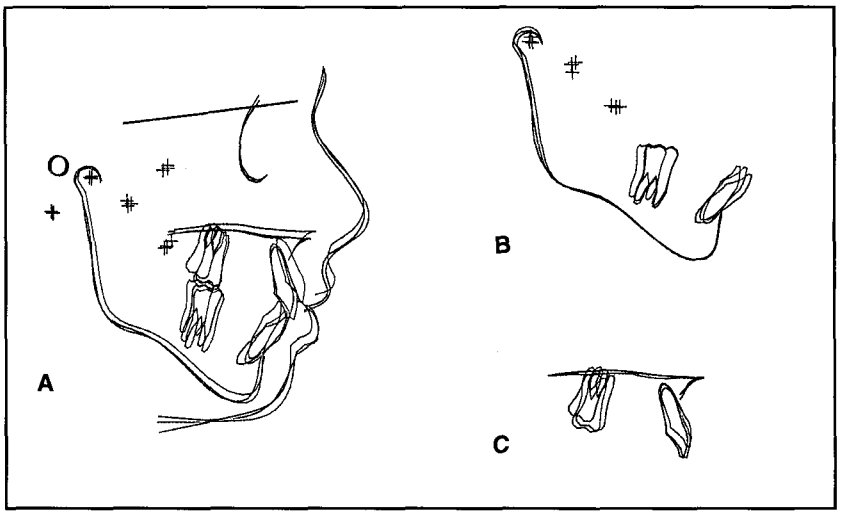

Figure 8A-C

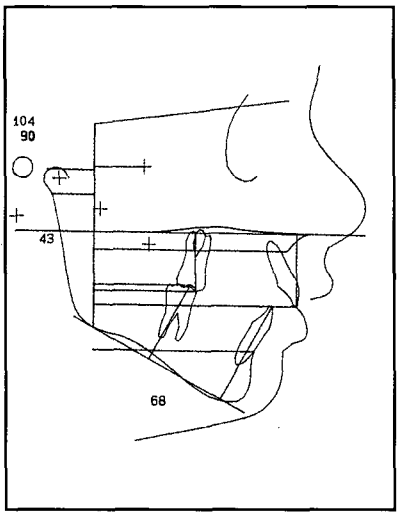

Figure 9

Figure 8A-C
A: Superimposition of pretreatment (black), immediate posttreatment (red), and 6 months posttreatment (blue) cephalograms. Computer-generated superimposition, on S-Na plane, registered on sella.
B: Computer-generated mandibular superimposition of pretreatment, posttreatment, and 6 months posttreatment cephalograms. Superimposition on lower border of mandible, registered on menton.
C: Computer-generated maxillary superimposition of pretreatment, posttreatment, and 6 months posttreatment cephalograms. Superimposition along palatal plane, registered on anterior nasal spine.

Figure 9
Computer-generated digital plot illustrating custom cephalometric analysis. Note reference plane extending from sella perpendicular to palatal plane.

Table 1
Cephalometric changes with Jasper Jumper therapy

Cephalometric parameter	Initial	Progress I	Progress II
Jarabak analysis			
SNA angle	82.2	79.4	80.2
SNB angle	75.0	73.9	74.7
ANB angle	7.2	5.5	5.5
SN to GoGn angle	36.4	38.0	36.8
Interincisal angle	125.2	116.3	121.2
Lower 1 to GoGn angle	92.2	110.5	101.9
Upper 1 to SN angle	106.2	95.3	100.0
OP to GoGn	18.2	9.4	13.6
Ramus height (mm)	42.8	41.7	42.4
Md. body length (mm)	67.8	68.9	70.9
Custom analysis (KJM/CMM analysis):			
U6 to palatal plane (mm)	19.9	15.7	19.2
U1 to palatal plane (mm)	24.8	28.1	28.4
L6 to mandibular plane (mm)	25.6	25.9	26.8
L1 to mandibular plane (mm)	32.3	31.5	32.9
U6 minus L6 (mm)	1.9	-6.6	-3.1
U1 minus L1 (mm) - overjet	8.5	0.0	2.5
AP discrepancy (Apt-Bpt) (mm)	11.1	9.2	9.6

Initial (pretreatment): 9 years 6 months
Progress I (at removal of appliance): 10 years 4 months
Progress II (6 months post removal of appliance): 10 years 10 months

design would overcome some of the previously published side effects of Jasper Jumper therapy, results of this case study indicate that en masse forward migration of the lower arch occurred with very little skeletal improvement. This dentoalveolar effect, in combination with the lack of forward mandibular development, indicates limited application of this treatment approach.

Acknowledgments

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