Upper Headgear Versus Lower Headgear, Yokes, and Class II Elastics

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The best known method for distal movement of molars in the upper jaw is via headgear. An alternative to this procedure is the use of sliding yokes, Class II elastics, and lower jaw headgear. At the orthodontic department of the University of Graz both methods are used.

Clinical observations have shown that the desired therapeutic effect of Class I occlusion was more rapidly achieved when maxillary molar teeth were distalized via yokes. The purpose of this study is to compare the two methods of distalization of upper molars: upper headgear versus lower headgear, yokes and Class II elastics (HGY-II).

Literature Review

A number of investigations are found in the orthodontic literature concerning the outcome of upper headgear on the skeletal relationship of maxilla to mandible.

Creekmore[1] compared headplates of patients using maxillary headgear with those of a control group without headgear. After an average time span of about 2.42 years a minimal reduction of the ANB difference was seen (treated patients —1.85°, untreated control group +0.53°). This was a result mainly because of the reduction of the SNA angle. Because of an increase of the SNB angle to the extent of 0.47° and of the SNPg value to an extent of 9.99°, Creekmore came to the conclusion that the maxillary headgear substantially inhibits the growth of the upper jaw. We think that these values are still within the measurement error span.

Wieslander[2] observed 30 children with cervical headgear therapy and 30 control children (at the age when second dentition took place). As a reference line he used a vertical line to the Frankfurt horizontal through the middle of the sphenoethmoidal plane. His measurements showed that the treated children had an inhibition of 1.91 mm in the forward growth of point A to the line of reference. The mandible showed no alteration of position. Due to the reaction of the palatal plane, Wieslander thought that the orthodontic force of headgear could also have a consequence on the palatal plane.

Blueher[3] discovered a reduction of an average of about 2° in the SNA angle in 34 children using cervical headgear. He also could not find a change of position of the mandible. His studies showed a slight increase of the palatal plane angle (+2°).

A study by King[4] using 50 Class II, Division 1 cases with maxillary cervical headgear plus complete banding also showed a posterior movement of point A.

Barton[5] compared two groups each consisting of 20 patients. One group had been treated with high-pull headgear, the other with cervical pull. He observed an increased extrusion of the upper molars with the cervical pull.

As far as we know the effect of the yoke mechanism, a main part of the Jarabak light-wire technique,[6] has only been investigated on a larger group by Droschl and Jarabak.[7] On a Class II, Division 2 group treated by Jarabak they investigated the longitudinal changes and found a reduction of the ANB difference by —1° to —2° which was due only to the reduction of the SNA value.

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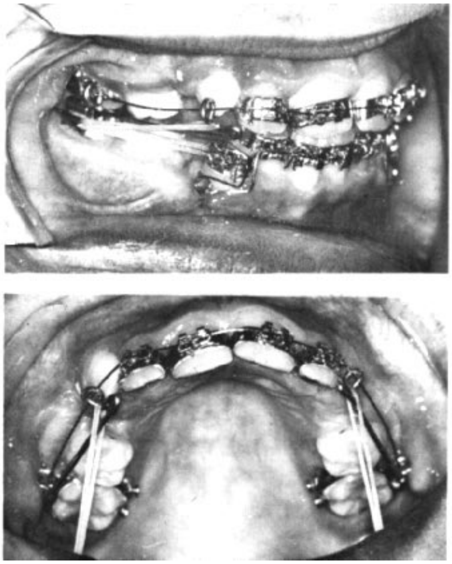

Fig. 1 Mechanism, lower headgear-yokes-Class II elastics. The lower molars are supported by a cervical headgear. The upper molars are distalized with yokes and Class II elastics.

The mechanism of headgear is well-known;[8] depending on the direction of force applied by cervical or different types of high-pull headgear the upper molars are moved bodily or tipped in a distal direction. The extraoral forces can also have an orthopedic effect on the maxilla.

Droschl demonstrated in animal experiments that extreme orthopedic forces in a cervical direction produce a strong clockwise rotation of the maxilla with the centre of rotation being the area about the zygomatic process.[9] Elder and Tuenge[10] showed by means of similar animal experimentation using a force direction exerted by high-pull headgear that this rotation could be completely avoided thus achieving a pure distocranial movement of the maxilla.

Mechanical Principles

The functional principles of the second method, lower headgear-yokes and Class II elastics (HGY-II mechanism), can be seen in Figure 1. The analysis

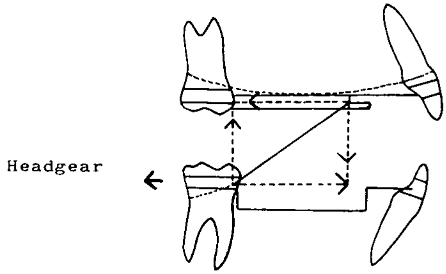

Fig. 2 Force diagram of the HGY-II mechanism.

of the force diagram shows a distal force vector to the upper molars and a mesial force vector to the lower molars, which is compensated by headgear use. Furthermore, an extrusive force is acting on the lower molars and extrusive and retrusive forces on the upper incisors (Fig. 2).

To counteract the undesired extrusion of the upper incisors a strong curve of Spee has to be bent in the upper arch. The extrusion and retrusion can also be compensated by the use of a Jarabak high-pull headgear. To achieve maximal effective horizontal forces the longest possible yokes are chosen. To regulate the exerted forces one can use different strengths of elastics. We employ an average force of 250 g per side. In cases of asymmetric molar position one can apply different degrees of force on both sides. These elastics are worn full time and replaced twice daily to ensure maximum effect. Thus a constant force is achieved as has been found to be optimal by Storey and Smith[12] and Reitan,[13,14] since a noncontinuous undermining resorption is inhibited and a continuous frontal resorption is achieved resulting in faster bone resorption and reconstruction.

The therapeutic application time for the mandibular headgear depends on the desired effect, if a simultaneous distalization of the molars is required or if the molars should only be stabilised. If only stabilization of the molars is desired, the headgear (with an average

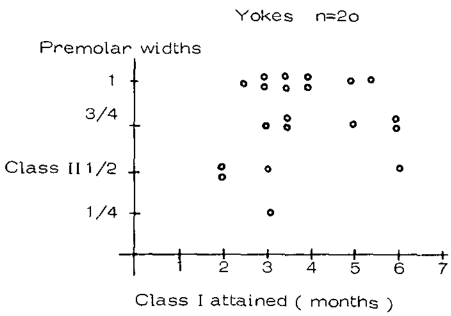

Fig. 3 Treatment time until Class I was attained using HGY-II.

force of 300 g) should be worn for 14-16 hours daily.

Results

Forty cases of Class II occlusion were examined; 20 were treated by HGY-II and 20 with upper headgear. In the latter group 13 cases were treated with cervical pull and the rest with high-pull headgear. The time span until Class I occlusion was achieved was registered.

Both groups had similar average ages (HGY-II 11.2 years, HG 10.4 years) and both showed optimal cooperation. The required wearing time for the elastics of the HGY-II mechanism 24 hours, upper headgear 18 hours per day was accomplished.

To demonstrate the results graphs were drawn with the vertical lines representing Class II in premolar widths and the horizontal lines representing the time required to achieve Class I occlusion (Figs. 3 and 4). It can be seen that the therapy duration is shorter using the HGY-II mechanism in comparison with the use of the upper headgear. The time saved by the HGY-II method is approximately 35 percent.

Cephalometric results

All headplates were analyzed by superposing on SN. Both groups showed the same decrease in ANB differences (—1°) due to a 1° reduction of SNA. The mechanics involved did not produce a change of the location of the mandible in the sagittal plane in either of the groups. A small increase of 2° of the mandibular plane angle (SN-GoMe) was noticed in the HGY-II group, in the headgear group 1° (Table I). The Y-axis, measured by the angle SN-SGn, of the HGY-II group increased 1°. No essential change of the sum of the saddle, articular and gonial angles could be detected. The facial height ratio does not show a significant alteration. The palatal plane showed

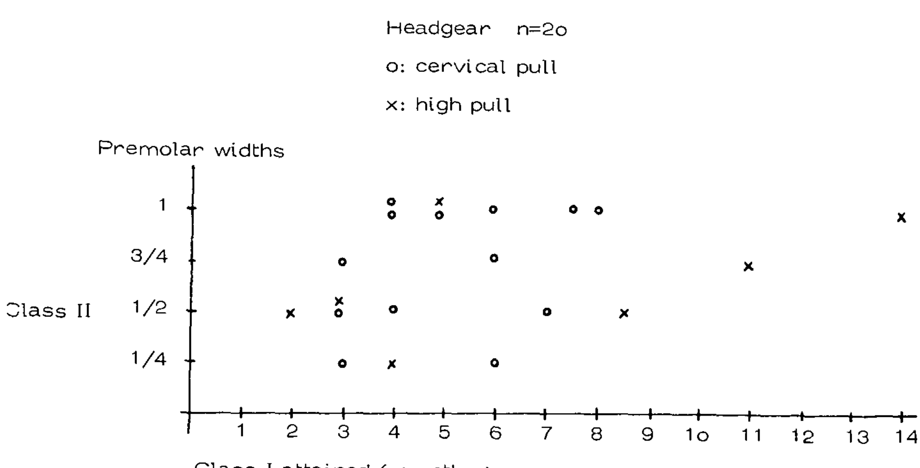

Fig. 4 Treatment time until Class I was attained using headgear with cervical or high pull.

TABLE I

There are no significant skeletal changes in both groups. Although an increase of anterior and posterior facial height can be seen, their ratios remain the same.

	HGY-II M. n=20	HG n=20	HG cervical n=13	HG combi n=7
SN-GoMe angle	+2°	+1°	+1°	0°
SN-SGN angle	+1°	0°	+1°	0°
posterior facial height, S-Go (mm)	+3	+2	+2	+3
anterior facial height, N-Me	+5	+3	+3	+5
$\frac{\text{post. facial height}}{\text{ant. facial height}} \times 100$	0%	0%	0%	0%
sum. of saddle, articular, gonion angles	+1°	+1°	+1°	0°
Palatal plane	+1°	+1°	+1°	+1°

TABLE II

The change of the angle of inclination of the first upper molar to SN indicates a distal tipping of the molars in all cases. In the HGY-II group the distal tipping seems to be more pronounced than with headgear.

	HGY-II M. n=20	HG n=20	HG cervical n=13	HG combi n=7
Angle of inclination of the first upper molar to SN	—15°	—7°	—8°	—6°

in all cases a tendency to rotate downward and backward one degree.

Dental changes

Lower molar distance was measured from the center of the occlusal plane of the first molar to the point of its projection on the Go-Me line. As assumed, this distance did not change in the HG patients. In the HGY-II group an extrusive effect (2 mm) on the anchorage molars was recorded. This extrusion is a result of the vertical forces exerted by the Class II elastics and also due to uprighting of the molars by the lower headgear.

With the measurement of the angle of inclination of the upper first molar to SN, a distal tipping could be seen, larger in the HGY-II group. Some tipping was also found by the use of the high-pull headgear (Table II).

Contrary to the headgear group where the incisal tooth positions remained the same, the HGY-II group showed a slight protrusion. The angle, measured in respect to Go-Me, increased to 2°. The distance of the incisal edge to the facial plane increased by 1 mm (Table III).

Upper incisors: In all cases the distance from the facial plane to the incisor edge decreased because of retrusion. A marked distal tipping, by which the axis angle (measured in respect to SN) decreased, is seen as a result of the anterior teeth banding of the HGY-II group (average —4°/—1 mm).

Both mechanisms showed reduction of the overjet, being greater in the HGY-II group. The bite opening seems to be most effective in the HGY-II group.

Conclusion

The use of a lower headgear-yoke-Class II mechanism on an average works faster than a maxillary headgear. The distal tipping of the molars is greater with HGY-II which may be the result of the quicker tooth movement. The speed of distalization is probably due to the effect of the constant force of the Class II elastics.

TABLE III
Positional changes of the incisors.

	HGY-II M. n=20	HG n=20	HG cervical n=13	HG combi n=7
Inclination of the lower incisor to GoMe	+2°	0°	0°	0°
Distance (mm) lower incisal edge to N-Po	+1	0	0	0
Inclination upper incisor to SN	—4°	+1°	0°	+3°
Distance upper incisal edge to N-Po	—2	—2	—2	—1
Overjet	—3	—1	—1	0
Overbite	—2	—1	—1	0

An orthopedic change on the maxilla could be seen if one can draw any conclusions from a change of only 1°. A reduction of the SNA angle and a slight clockwise rotation of the palatal plane was noticed. These results agree with earlier investigations about cephalometric changes with headgear therapy.[1-5]

We have come to the conclusion that both methods are indicated. We use the upper headgear especially at a time when a complete therapy is not possible because of noneruption of the permanent teeth. The HGY-II mechanism is indicated when most permanent teeth are available and thus the therapy can be completed in one treatment period.

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