The effect of a partial bite-raising splint on the inclination of upper and lower front teeth

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In a previous paper it was maintained that the effect of the permanent use of an anterior partial bite-raising splint was an intrusion of the front teeth and an eruption of the others. However, the effect might have been merely a change in the inclination of the front teeth. The present study comprised the same material as earlier. Linear and angular changes in the position of upper and lower incisors were measured on cephalometric radiographs. In the upper jaw a possible average proclination occurred, whereas in the lower jaw no or only a very small retroclination took place. The values were well within the method error, and it was concluded that the effect of the splint had been one of intrusion of the upper and lower front teeth and not merely a change in their inclination. □ *Orthodontics; tooth intrusion; tooth position*

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A method has been described to obtain space for crowns to be made on heavily attrited front teeth by using a partial chrome–cobalt splint covering the palatal surfaces of the six upper front teeth (4). The effect of this type of treatment on the occlusal vertical dimension of 20 patients has been reported (3). It was claimed that the front teeth were intruded while the teeth of the lateral segments erupted during the splint treatment. The mean amount of intrusion was 1.05 mm and that of eruption 1.47 mm.

The aim of this study was to verify whether the inclination of upper and/or lower anterior teeth had been altered as a result of this treatment.

Materials and methods

The 20 patients of a previous study (3) composed the material of the present one also. There were 6 women and 14 men wearing partial anterior chrome–cobalt splints for 6–14 months. The age ranged from 18 to 50 years.

Cephalometric radiographs without the splint in situ taken at the beginning and at the termination of the treatment were used for the measurements. All radiographs were measured twice with at least a week's interval, using the CM–1 digital read-out system (2). Both linear and angular changes of the central incisors of both jaws were recorded. In the upper jaw the nasal line (NL) and in the lower jaw the mandibular line (ML) were used as the base line (1). Linear changes were recorded as changes in distance A–B between a perpendicular from the upper tantalum implant on the NL line and a perpendicular from the labial surface of the central incisors on the same line. Similar perpendiculars were drawn in the lower jaw, and changes in the distance C–D were recorded (Fig. 1). The angles measured were the obtuse angle between the tooth axis (IL_s) and the NL line in the upper jaw and between the tooth axis (IL_i) and the ML line in the lower jaw (Fig. 1). Their sum indicates the size of the interincisal angle. A difference between the sums before and after treatment gives an estimate of changes in the interincisal angle. A positive difference—a decrease in the interincisal angle—means a proclination, whereas a negative value—an increase in the interincisal angle—represents a retroclination of the incisors.

The error of the method was calculated

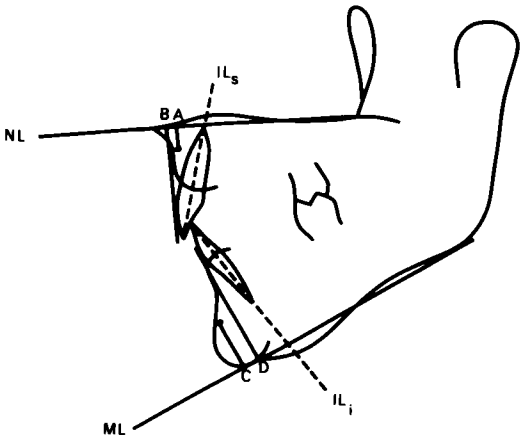

Fig. 1. Cephalometric tracing demonstrating linear and angular measurements.

by the formula

$$\frac{\sum(x_a - x_b)^2}{2N},$$

x_a being the figure obtained for the first measurement and x_b the second on the radiograph taken at the termination of the treatment.

Results

The results are given in Tables 1, 2, 3, and 4.

In the upper jaw the mean linear change was a proclination of 0.07 mm, with an SD of 0.24 mm and a range of −0.4 to +0.5 mm, and the mean angular change was a proclination of 0.07°, with an SD of 1.23° and a range of −3.5° to +2.3°.

In the lower jaw the mean linear change was a retroclination of 0.01 mm, with an SD of 0.24 mm and a range of −0.6 to +0.5 mm, and the mean angular change was a retroclination of 0.04°, with an SD of 0.81° and a range of −1.8° to +2.0°.

Table 2. Incisal angles IL_s/NL, IL_i/ML (°) before and after biting on a partial bite-raising splint

	Mean	SD	Range
Upper jaw			
Before	104.9	7.04	84.2–112.7
After	104.9	7.21	84.2–111.8
Lower jaw			
Before	97.4	6.63	84.3–110.7
After	97.4	6.57	84.9–111.5

No correlation was observed between linear and angular changes in either jaw. The correlation coefficients were r = 0.04 in the upper jaw and r = 0.14 in the lower jaw.

The mean upper incisal angle was 104.9°, with an SD of 7.04° and a range of 84.2° to 112.7° before the treatment, and 104.9°, with an SD of 7.21° and a range of 84.1° to 111.8° after the treatment. The corresponding figures for the lower incisal angle were 97.4°, with an SD of 6.63° and a range of 84.3° to 110.7°, and 97.4°, with an SD of 6.57° and a range of 84.9° to 111.5°.

The average change in interincisal inclination was a proclination of 0.03°, with an SD of 1.53° and a range of −3.8° to +3.5°.

The method error ($s_{(i)}$) was 0.16 for the linear measurement and 0.71 for the angular one in the upper jaw; in the lower jaw the corresponding figures were 0.10 and 0.51.

Discussion

Owing to the inclination of the upper and lower front teeth, biting on a splint covering only the palatal surfaces of the upper front

Table 1. Linear and angular changes in the position of upper and lower incisors biting on a partial bite-raising splint

	Linear change (mm)			Angular change (°)		
	Mean	SD	Range	Mean	SD	Range
Upper jaw (proclination)	0.07	0.24	−0.4 to +0.5	0.07	1.23	−3.5 to +2.3
Lower jaw (retroclination)	0.01	0.24	−0.6 to +0.5	0.04	0.81	−1.8 to +2.0

Table 3. Individual changes (°) in interincisal angle as a result of biting on an anterior partial bite-raising splint

Pat. no.	Sex	Age, years	Pre-treatment			Post-treatment			Changes*
			$IL_s/NL°$	$IL_i/ML°$	$IL_s/NL° + IL_i/ML°$	$IL_s/NL°$	$IL_i/ML°$	$IL_s/NL° + IL_i/ML°$	
1	M	39	109.7	102.4	212.1	110.5	102.1	212.6	+0.5
2	M	42	100.6	96.7	197.3	97.1	96.4	193.5	−3.8
3	M	50	84.2	86.6	170.8	84.2	86.7	170.9	+0.1
4	M	26	110.8	93.3	204.1	110.6	93.5	204.1	0
5	M	35	110.1	96.8	206.9	110.4	97.6	208.0	+1.1
6	M	39	105.7	105.4	211.1	105.5	105.5	211.0	−0.1
7	F	36	107.2	97.5	204.7	109.0	97.5	206.5	+1.8
8	F	25	104.5	110.7	215.2	106.8	111.5	217.3	+2.1
9	M	49	106.7	98.5	205.2	107.3	98.1	205.4	+0.2
10	M	39	111.2	100.6	211.8	110.6	99.9	210.5	−1.3
11	M	27	112.7	94.6	207.3	111.8	94.5	206.3	−1.0
12	F	44	106.5	97.2	203.7	106.5	95.4	201.9	−1.8
13	F	34	89.7	104.6	194.3	89.7	103.3	193.0	−1.3
14	M	25	107.7	84.3	192.0	106.1	84.9	191.0	−1.0
15	M	18	107.7	96.6	204.3	109.2	98.6	207.8	+3.5
16	F	27	105.8	92.7	198.5	106.3	93.1	199.4	+0.9
17	M	23	108.4	91.7	200.1	108.5	92.4	200.9	+0.8
18	M	49	101.1	99.9	201.0	101.2	100.4	201.6	+0.6
19	F	38	100.5	90.8	191.3	101.2	90.0	191.2	−0.1
20	M	28	106.7	106.7	213.4	106.3	106.5	212.8	−0.6
$\bar{x}$					202.3			202.3	0.03
SD					10.14			10.53	1.53

* A plus sign denotes proclination of incisors as compared with initial position; a minus sign denotes retroclination of incisors as compared with initial position.

teeth might theoretically cause a change in their inclination and not merely an intrusion as claimed in a previous paper (3). The risk would possibly be smaller in the upper jaw since the splint was attached to canines and first premolars on both sides, thereby causing the chewing forces to act on a large block of teeth and periodontium instead of on individual teeth. However, the mean values for both linear and angular changes were very small and well within the method error. In the upper jaw the average result was a small proclination, if any, whereas in the lower jaw a possible retroclination occurred. The ranges indicate that the individual variations were fairly large, which is to be expected in a clinical material.

Table 4. Incisal angles IL_s/NL, IL_i/ML (°) at the beginning of the treatment as related to sex. For comparison, the corresponding data obtained by Sarnäs & Solow (5) are also presented

		Own material		Sarnäs & Solow	
	Sex	Mean	SD	Mean	SD
Upper jaw	M	105.95	7.16	109.08	6.90
	F	102.37	6.64	109.83	6.89
Lower jaw	M	96.72	6.41	94.44	7.36
	F	98.92	7.49	94.13	5.85

With regard to the individual changes in the interincisal angle only 7 out of 20 were larger than the combined errors of the method for the angles IL_s/NL and IL_i/ML. Solow (6) refers to other authors reporting much higher values, indicating that the two extremes in the present material might be due to errors of the method and not represent real changes in inclination.

When the individual changes in interincisal angulation (Table 3) were compared with corresponding figures for intrusion and eruption (Table 1 in Ref. 3), we found that only in patient 15 might the effect of the splint have been that of a proclination rather than that of intrusion. However, the age of the patient might possibly account for this finding.

The initial incisal angles might influence any resulting changes in angulation. The

mean upper incisal angle of the material was 105.6° for men and 102.4° for women; the mean lower incisal angle was 96.7° and 98.9°, respectively (Table 4). No directly comparable material has been found in the literature. Sarnäs & Solow's (5) report (Table 4) concerns early adulthood, and their figures differ, those for the upper jaw being nearly 3° greater for the men and 7° greater for the women. For the lower jaw the figures were 2° and nearly 5° smaller, respectively. All the same, the discrepancy is small enough to justify the assertion that the present material was within normal limits in this respect.

It can be concluded, therefore, that the effect of the partial chrome–cobalt splint has been on an average one of intrusion and not of proclination/retroclination of the front teeth.

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