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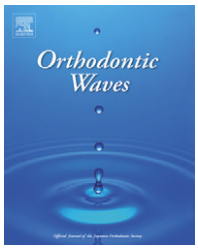

Research paper

Changes in facial profile during orthodontic treatment with extraction of four first premolars

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ABSTRACT

The present study was designed to evaluate soft tissue profile changes after the orthodontic treatment of class I bimaxillary dentoalveolar protrusion in adult cases. Pre- and post-treatment cephalograms of 20 Caucasian female class I bimaxillary dentoalveolar protrusion patients were selected from private practice. All of them were treated by extraction of four first premolars, and banded and bonded by 022 × 028 standard edgewise technique. *t*-Test was used to analyze pre- and post-treatment cephalograms. This study showed that upper and lower lip protrusions were decreased respectively 2.7 ± 2.9 mm ($p < 0.001$) and 2.8 ± 2.8 mm ($p < 0.001$). The mean changes of upper and lower lip thickness and length, as well as nasolabial and labiomental angles were not significant. Significant positive correlation was found between changes of maxillary and mandibular incisors with changes in upper lip ($r_{UI} = 0.70$, $p < 0.001$, $r_{LI} = 0.59$, $p < 0.006$) and the lower lip positions ($r_{UI} = 0.64$, $p < 0.002$, $r_{LI} = 0.72$, $p < 0.001$). By using stepwise regression it was found that a ratio of 0.63:1 was obtained between upper lip retraction and maxillary incisor retraction and a ratio of 0.62:1 was obtained between lower lip retraction and mandibular incisor changes. This study concluded that, a strong correlation exists between anterior tooth retraction and the position of both lips.
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1. Introduction

The response of soft tissue to retraction of the maxillary and mandibular incisor of bimaxillary dentoalveolar protrusion is still a matter of controversy. There is a general agreement that orthodontic treatment may influence the soft tissue profile, but still there is a disagreement on the amount of changes of soft tissue following anterior teeth retraction. Some studies showed a definite correlation between incisor movement and soft tissue changes [1–14] other researches showed that profile improvement in patients treated with four premolar extractions have varied greatly [15–21].

The present study was undertaken to determine the change of upper and lower lips to orthodontic incisor movement in patients treated with extraction of four first premolars.

2. Materials and methods

Data were obtained from pre- and post-treatment lateral film-based cephalometric radiographs of 20 Caucasian female patients. The mean age was 16 ± 6 years. The minimum age of 12 and the maximum age of 38 years were selected at the

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beginning of treatment in order to minimize the growth effects. One dentist measured all of the cephalometric data and manually traced them. To evaluate the tracing and measurement errors associated with the method, 10 radiographs from 5 patients were selected at random and then traced and measured twice. The result of the paired *t*-test showed that there were no significant differences between the two sets of measurements at the 95% confidence level. The selection criteria for those patients were as following:

(1) Class I malocclusion and bimaxillary dentoalveolar protrusion.
(2) Lips were separated at rest by more than 3–1 mm (lip incompetence).
(3) Lips were prominent and everted which was evaluated by observing the distance that each lip projects forward from a true vertical line through the depth of the concavity [22].
(4) $1 < ANB < 4$, 1 to SN $> 100^\circ$, IMPA $> 90^\circ$.
(5) No congenitally missing teeth (excluding third molars).
(6) No functional appliance or surgical procedures were applied.

All patients were treated by one practitioner and in all patients four first premolars were extracted. Standard 022×028 edgewise appliance with sliding mechanics was used and none of the patients had extra oral anchorage. Average period of treatment was 36 ± 11 months. Pre- and post-treatment lateral cephalograms were carefully traced by one operator and a reference line was established (a constructed line perpendicular to sella-nasion minus 7° through sella = SR), the liner measurements were the maxillary incisor tip to SR, the mandibular incisor tip to SR, upper lip protrusion (the most anterior point of the upper lip (Ls) to SR), lower lip protrusion (the most anterior point of the lower lip (Li) to SR), Upper lip thickness (Ls to the most anterior point at upper incisor crown), Lower lip thickness (Li to the most anterior point at lower incisor crown), Upper lip length (Sn-Stm^s), and Lower lip length (Sm-Stm^i). Angular measurements were nasolabial, labiomental, 1 to SN, IMPA, Y-axis, Go-Gn to SN, 1 to 1, SNA, SNB and ANB angles (Fig. 1). The magnification factor of cephalograms was standardized at 8%. Paired *t*-test, Pearson Correlation, and stepwise multiple regression were used for analyzing pre- and post-cephalograms. Multiple regression was used because there was more than one variable. Statistical software of SPSS, Version 9 was used in order to examine the data.

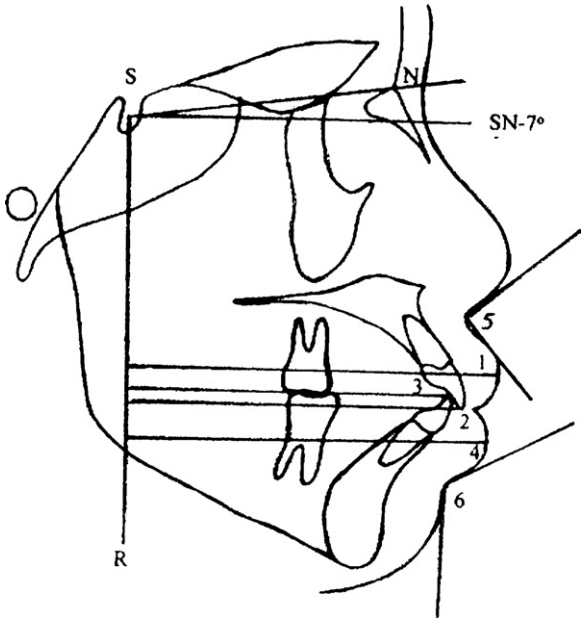

Fig. 1 – Reference line and landmarks. R, reference line; 1, most anterior point of upper lip to reference line; 2, maxillary incisor tip to reference line; 3, mandibular incisor tip to reference line; 4, most anterior point of lower lip to reference line; 5, nasolabial angle; 6, labiomental angle.

3. Results

Tables 1 and 2 show the means, S.D.s and *p*-values between pre- and post-treatments. Paired *t*-test showed that maxillary and mandibular incisor tips were retracted by an average of 4 ± 3.2 mm ($p < 0.001$) and 4.2 ± 3.3 mm ($p < 0.001$), respectively. Therefore, the upper lip was retracted to an average of 2.7 ± 2.9 mm ($p < 0.001$) and lower lip was retracted to an average of 2.8 ± 2.8 mm ($p < 0.001$). The nasolabial and labiomental angles increased $2.6 \pm 7.8^\circ$ and $5.1 \pm 12.6^\circ$, respectively. 1 to SN and IMPA angles were decreased $10.3 \pm 5.8^\circ$ and $8.3 \pm 5.2^\circ$, respectively ($p < 0.001$). The Pearson correlation test (Table 3) showed significant positive correlation between changes in the maxillary and mandibular incisor position with the changes in the upper lip position ($r_{UI} = 0.70$, $p < 0.001$, $r_{LI} = 0.59$, $p < 0.006$) and lower lip position ($r_{UI} = 0.64$, $p < 0.002$, $r_{LI} = 0.72$, $p < 0.001$). Stepwise multiple regressions showed that a 1-mm maxillary incisor tip retraction will produce

Table 1 – Pre- and post-cephalometric linear measures

Variables	Pre-treatment $\bar{x} \pm$ S.D.	Post-treatment $\bar{x} \pm$ S.D.	Difference $\bar{x} \pm$ S.D.	*p*-Value
UI to SR	68 ± 6.3	64 ± 5.3	-4 ± 3.2	0.001
LI to SR	64.6 ± 6.9	60.4 ± 5.8	-4.2 ± 3.3	0.001
Ls to SR	81 ± 5.6	78.2 ± 5.2	-2.7 ± 2.9	0.001
Li to SR	76 ± 6.7	73.4 ± 6.2	-2.8 ± 2.8	0.001
Upper lip thickness	11.4 ± 2.1	11.6 ± 2.3	$+0.2 \pm 1.8$	0.7
Lower lip thickness	13.8 ± 2.1	13.9 ± 2.2	$+0.04 \pm 1.6$	0.9
Upper lip length	18.5 ± 2.2	18.9 ± 3.2	$+0.4 \pm 1.6$	0.3
Lower lip length	17.5 ± 2.6	17.9 ± 2.7	$+0.5 \pm 1.6$	0.2

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