

Lip Position Changes in Angle Class I Malocclusion after Orthodontic Treatment, with and without Extractions

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ABSTRACT Objective: To investigate the effect of Angle Class I malocclusion after orthodontic treatment, with and without extractions on lip position changes. **Methods:** 30 patients with Angle Class I malocclusion were chosen. 15 patients were treated by 4 first-premolars extraction (Group A) and 15 patients were treated without extraction (Group B). The soft tissue X-ray cephalometric of the patients were measured before and after the treatment and compared statistically. **Results:** After the extraction treatment, the upper and lower projecting lip reduced by 1.42 mm and 2.03, mm respectively. The length of the upper and lower lips increased by 0.51mm and 1.58mm, respectively. For the group B, the nasolabial angle, the lower lip protrusion, the length of upper and lower lips had been increased, though there had no statistical significance before and after treatment. **Conclusions:** After extraction treatment the upper and lower projecting lips decreased. The patients with extractment treatment had the facial aesthetics.

Key words: Angle Class I malocclusion; lip position; X-ray cephalometric

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Introduction

The effects of orthodontic treatment on facial profile and lip position, with or without the extraction of teeth, had greatly concerned orthodontists [1]. Young and Smith (1993) [2] compared the general effects on the facial profile of orthodontic treatment either with or without extractions, and indicated that it was simplistic and incorrect to blame undesirable facial aesthetics after orthodontic treatment, exclusively on the extraction of premolars. Proffit stated that in borderline cases, nonextraction treatment was more efficient, a further incentive to treat in that way if feasible [3]. Lips occupy an important position in the face of soft tissue structure, changes of lip's form and position can bring significant influence on facial form. Early in the 18th century, Hunter pointed that one of the aims of malocclusion correcting was to have coordinated lip shape. Case believed that facial profile was an important clue to malocclusion correction plan's making [4].

The main aim of this current study was to compare the profile response of the soft tissues for the lip in Angle Class I malocclusions treated by means of extraction of four premolars, (where no doubt existed about such a procedure), with the response of more borderline cases which presented with a similar malocclusion but treated without extractions. It can provide references for clinical treatment to design and effect prediction.

1 Materials and methods

1.1 Patients

From 2007-2009, 30 patients who came from the Department of Orthodontics, Affiliated Hospital of Medical College Qingdao

University with Angle Class I malocclusion were chosen in the study. They were treated by Straight Wire Appliance (Hangzhou Xinya metal brackets) and selected randomly. 15 patients, including 7 males and 8 females, underwent extraction of four first premolars (Group A), while 15 patients, including 8 males and 7 females, did not undergo extraction of teeth (Group B). The average age of the patients at the beginning of treatment was 15.9 years and the average treatment duration with the Straight Wire Appliance was 1.8 years.

The criteria for selection were as follows: (1) All the patients used the same machine to take lateral cephalometric headfilms before and after treatment. All radiographs were taken on the same cephalostat with the patient in a standing position and natural head relaxed-lip posture, the teeth in centric occlusion, and the Frankfort plane parallel to the horizontal. The record of clinical treatment were conserved completely; (2) Angle Class I malocclusion (ANB 0~5, FH-MP 22.5~31.9) with the dental crowding was 4~8mm and non-bimaxillary protrusion; (3) There was no systemic disease, no severe craniofacial asymmetry, no congenital missing tooth and supernumerary tooth; (4) There was no obvious symptoms of temporomandibular joint; (5) They all received class I molar relationship, normal overjet and normal overbite after treatment; (6) There was no history of orthodontic treatment.

1.2 Methods

The analysis of facial attractiveness was based on key cephalometric soft tissue landmarks relevant to optimal orthodontic and surgical-orthodontic treatment. Cephalometric measurements are static, it is critical that the orthodontist consider possible changes in a soft tissue trait resulting from growth, orthodontic and/or surgical movement, and possible muscle forces.

All the lateral headfilms were measured on sulfate tracing paper with 4H pencil, using the compass and electronic digital caliper (GB/T14899-94, precision 0.01mm, Jiang Su-Jingjiang) to

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complete the measurement of angle and line spacing. The lip position analysis was detected from 8 points along the facial profile, 2 points on the labial mucosa. The fixing of points and the methods for measurement were referred to Fu Minkui's [5-7] experiment. In order to ensure the accuracy of measurement, all the X-ray cephalometric were measured by the same doctor in a certain period of time and each lateral headfilm was measured 3 times continuously to get the average value. If the error which was greater than 0.1 mm two times, the X-ray film should be re-measured. Ten individuals (5 from each group) were randomly selected from the sample and remeasured at 1-week intervals by the same individual investigator to ensure measurement accuracy. Then, the two groups of data were contrasted by t-test, if no statistically significant differences were found ($P>0.05$), the date was reliable and could be included in this study.

The measured values of facial soft tissue were as shown in Fig 1.

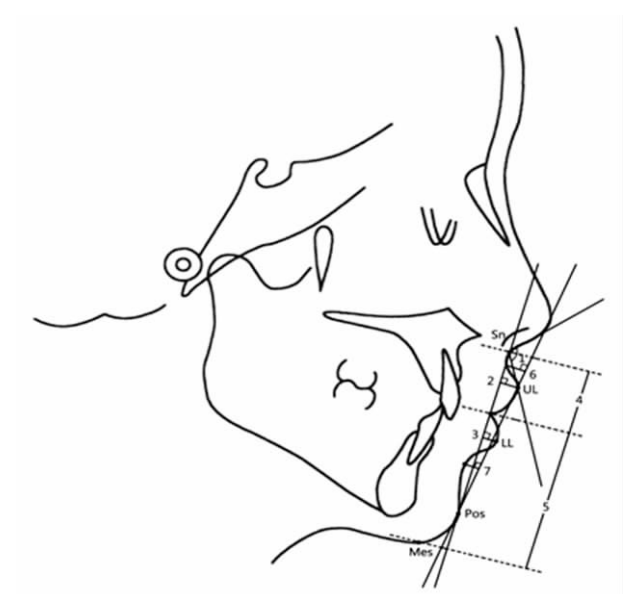


Fig 1. The sketch map of cephalometric measurement 1. Nasolabial Angle (NLA) 2.Upper Lip Protrusion(ULP) 3. Lower Lip Protrusion (LLP) 4. Upper Lip Length (ULL) 5. Lower Lip Length (LLL) 6. Upper Lip Concave Depth (ULCD) 7. Mentolabial Furrow Depth (MFD)

1.3 Statistical analysis

SPSS11.5 software package was used to analysis the date for each group. Changes between the pretreatment and posttreatment were evaluated by paired t text.

2 Results

The supporting statement of the changes of soft tissue before and after treatmen was shown in Table 1, Table 2. For the Angle Class I malocclusion patients, the upper and lower lip protrusion were ameliorate evidently after the extraction treatment, the average of decrease for the upper lip protrusion was 1.42mm while which was 2.03 mm for the lower lip protrusion; the length of upper lip increased 0.51mm and lower lip length increased 1.58 mm;

There were statistically significant differences for mentolabial furrow depth before and after treatment, which increased to 1.03 mm; The average variation of nasal labial angle changed form 101.52° to 99.65° ; The average change of upper lip concave depth was from 7.36 mm to 6.13 mm, but these two measurements before and after treatment had no statistically significant differences ($P>0.05$). For the none extraction treatment group, the nasal labial angle, the lower lip protrusion, the upper and lower lip length all increased, but they had no statistically significant differences before and after treatment ($P>0.05$). There was no significant change for upper lip protrusion, upper lip concave depth and mentolabial furrow depth ($P>0.05$).

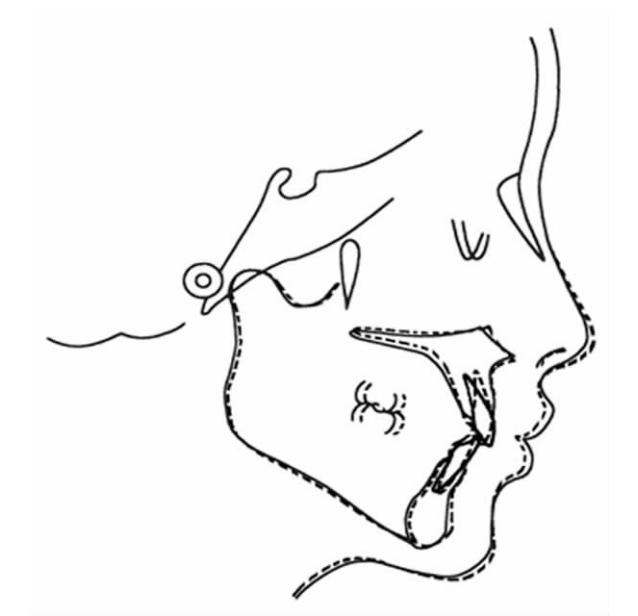


Fig 2. The sketch map of lip position mean changes before and after treatment for the teeth-extracted patients. _____ Lip position mean changes before treatment for the teeth-extracted patients. ----- Lip position mean changes after treatment for the teeth-extracted patients.

Table 1 The measured value for Angle Class I malocclusion before and after extraction treatment $\bar{X} \pm S$

	Pretreatment	Posttreatment	Change
NLA	101.52± 12.82	99.65± 12.34	-1.87
ULP	7.64± 1.88	6.22± 1.92*	-1.42
LLP	6.64± 2.54	4.61± 2.19**	-2.03
ULL	22.87± 1.92	23.38± 1.67	+0.51
LLL	46.57± 4.10	48.15± 3.66*	+1.58
ULCD	7.36± 2.51	6.13± 1.64	-1.23
MFD	3.69± 1.50	4.72± 1.76*	+1.03

* $P<0.05$ ** $P<0.01$



Fig 3. The sketch map of lip position mean changes before and after treatment for the no teeth-extracted patients.
—— Lip position mean changes before treatment for the no teeth-extracted patients.
----- Lip position mean changes after treatment for the no teeth-extracted patients.

Table 2 The measured value for Angle Class I malocclusion before and after none extraction treatment $\bar{x} \pm s$

	Pretreatment	Posttreatment	Change
NLA	93.04± 7.66	93.96± 10.34	+0.92
ULP	7.30± 1.67	7.24± 1.23	-0.06
LLP	6.18± 2.12	6.43± 1.25	+0.25
ULL	23.08± 2.21	23.44± 2.11	+0.36
LLL	47.70± 3.38	50.62± 3.46	+2.92
ULCD	6.91± 1.25	6.40± 1.42	-0.51
MFD	3.78± 1.23	3.59± 1.23	-0.19

*P<0.05 **P<0.01

3 Discussions

In the history of orthodontic treatment there were two extreme one-sidednesses between extraction and non extraction [8], it was mainly because there was much controversy in the extraction for orthodontic sector all the time. But no doubt that the goal of orthodontic treatment was to achieve balanced, stable and beautiful feature [9]. Tweed considered that the primary goal of orthodontic treatment was to achieve "satisfactory facial appearance," and stressed that the relationship between the lower lip and chin in the treatment planning played an important position [10]. Recently, the topic of lip position changes has become important for orthodontists because more orthodontic patients evaluate the outcome of treatment by their smiles and the overall enhancement in their facial appearance. Although orthodontic treatment is based primarily

on occlusal relationships, greater attention is now paid to enhancing dentofacial characteristics to produce optimal facial esthetics. With the updated concept of orthodontic treatment, good facial profile has become an important criterion to judge the efficacy of orthodontic treatment.

To judge the changes of the lips' position after orthodontic treatment correctly, firstly, there should be an objective standard. Usually it can be judged by the two lip positions: lusitropic lip position and closed lip position. The lip muscle is in a relatively relaxed state in lusitropic lip position, which is the natural state of the lip and can be repeated, so it can reflect the objective form of lip [11]. The lusitropic lip position is also different when the mandible lie in rest position and intercusping position. When describing the difference between these two position, Burstone considered that the major change was mentolabial furrow [12]. All the data were gathered when the lip lied on the lusitropic position to analyze the lip position changes in this study and the purpose was to objectively analyze the change of lip morphology before and after treatment.

At the present time, the study for lip position before and after treatment are focused on the profile changes. Generally, the estimate is come from two aspects, including upper and lower lip protrusion changes and lip length changes. The factors of these changes that affect the lip position, are closely related with the degree of tooth movement and thickness of lip soft tissue. Anterior teeth are the supporter of the lip tissue. The more the teeth protrusion changed, the greater the impact on the lip protrusion. In a general view that the treatment takes no significant change on the lip thickness, but the thicker the lip is , the smaller the change of lip protrusion which follow with the movement of anterior teeth is, the longer the time required to change, this may be related to the lip tension. The study of Zhang J [13] found that after the extraction treatment the nasal labial angle and the length of upper lip increased, but the upper lip protrusion reduced, the facial soft tissue balance was improved. The lower lips of the extraction patients (extraction of four first premolars) were retracted evidently and the mentolabial furrow became deepen to compare with the non-extraction patients[14].

In essence, after the extraction treatment of Angle I malocclusion, the changes of lips shape were as follows: the lower lip protrusion reduced, the lower lip length and mentolabial furrow depth increased, which were the same as Yuan XP [15]. The results of this study suggested that extraction treatment helped to reduce the upper and lower lip protrusion and, consequently, improved the soft tissue profile. There had no statistically significant differences for non-extraction treatment's patients between before and after treatment, which suggested that non-extraction treatment had little effect on the lips position. To some degree, it negated that the view of which the upper and lower lip protrusion would be increased af-

ter non-extraction treatment for the Angle Class I malocclusion crowding patients. Therefore, for the Angle Class I malocclusion borderline cases, when deciding whether or not to extract teeth for the treatment, we should take into account of the changes in the lip position sufficiently.

In conclusion, the change of the lip's position before and after orthodontic treatment is a complex process, it is a three-dimensional structure's change actually. Extraction treatment put a certain effect on the lips form, so clinical practice should be taken into account during the development of treatment programs.

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安氏 I 类错合拔牙与非拔牙矫治对口唇形态影响的研究

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摘要 目的:研究安氏 I 类错合拔牙与非拔牙矫治对口唇形态的影响。**方法:**从直丝弓矫治的 Angle I 类错合患者治疗前后的 X 线侧位片中随机选取拔除 4 个第一前磨牙患者 15 例(A 组),非拔牙矫治患者 15 例(B 组),经 X 线头影软组织测量分析比较矫治前后拔牙组与非拔牙组口唇形态的变化,对所得数据进行统计学处理。**结果:**拔牙矫治后上下唇的突度有明显改善,平均减少 1.42 和 2.03 mm;上下唇的长度也平均增加 0.51 和 1.58 mm;非拔牙矫治患者治疗后鼻唇角、下唇突度、上下唇长度均有增加,但矫治前后无统计学差异。**结论:**拔牙矫治有利于减小上下唇突度从而改善软组织侧貌。

关键词:Angle I 类错合;口唇形态;头影测量

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