

# 骨格性?級不正咬合の 抜歯・非抜歯ボーダーライン 症例における 治療前後の比較 - セファロ分析と模 型分析による評価 -

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# Abstract

## Pre- and Post-treatment comparison in extraction and non-extraction borderline cases with skeletal Class I malocclusion

— Evaluation of cephalometric and model analysis —

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## 【INTRODUCTION】

The selection criteria in terms of extraction or non-extraction decision in orthodontic treatment are the discrepancy between the size of the tooth and the alveolar arch, the anteroposterior relationship between the maxillary and mandibular, the vertical relationship between the maxillary and mandibular, the angle of the long axes of the maxillary and mandibular central incisors and the position of upper and lower lip. Thus, we take account of these criteria when we select extraction or non-extraction treatment.

However, even if everything else considered, there are borderline cases in which orthodontic treatment can be treated with or without tooth extraction in daily clinical practice.

This study was aimed to evaluate the effect of selecting extraction or non-extraction orthodontic treatment outcome regarding to extraction and non-extraction borderline case in skeletal Class I malocclusion.

## 【MATERIALS AND METHODS】

### 1. The patient selection process

- 1) This study selected the 1533 cases who had orthodontic treatment with edgewise appliance from the total 4041 cases at the Department of Orthodontics, Health Sciences University of Hokkaido Hospital and Dental Clinic. The 1533 cases with congenital missing teeth, excess teeth, and periodontal disease were excluded.
- 2) Cephalometric analysis was performed. The 1533 cases were selected the 438 diagnosed as skeletal Class I malocclusion on condition that ANB angle(AB difference) was  $2.94 \pm 1.52$  degrees.
- 3) This study used the Konstantonis's analysis of the extraction or non-extraction borderline case in skeletal Class I malocclusion.

The 438 cases selected the only 13 extraction cases on condition that the Konstantonis's analysis of the extraction borderline case was the range of the mean  $\pm$  standard deviation. Whereas the 438 cases selected the 20 non-extraction cases on condition that the Konstantonis's analysis of the non-extraction borderline case was the range of the mean  $\pm$  standard deviation. Considering sample size, the 20 non-extraction cases selected the latest 13 cases on condition that the Konstantonis's analysis of the non-extraction borderline case was the range of the mean

± standard deviation.

This study selected women only for the purpose of not considering gender differences.

## 2. Cephalometric analysis

Cephalometric analysis was performed at the pre- and post-treatment each extraction and non-extraction group. Cephalometric analyses of 9 measurements were evaluated with the skeletal and dental pattern analysis. Cephalometric analyses of 11 measurements were evaluated with the soft tissue analysis. As for Overjet and Overbite, there were not measured by the cephalometric analysis but measured by the dental casts used the dental caliper.

## 3. Model analysis

Model analysis was performed at the pre- and post-treatment each extraction and non-extraction group. Model analysis of 9 items were evaluated using The American Board of Orthodontics Objective Grading System (ABO-OGS)

## 4. Digital model analysis

The dental casts scanned with digital scanner(RexcanDS2®, SOLUTIONIX) and the measurements were performed software (Ortho Analyzer®, 3Shape). Digital model analysis was performed at the pre- and post-treatment each extraction and non-extraction group. Digital model analysis of 6 items were evaluated with the intercanine, intermolar widths and arch perimeters for maxillary and mandibular

## 5. Statistical analysis

Statistical analysis was carried out using software(SPSS® ver.23.0, IBM). The mean difference that each treatment group experienced from pre- and post-treatment were compared using Student's *t* test. The significance level was predetermined at 5 %.

## **【RESULTS】**

### 1. Comparison of pre-treatment, non-extraction group vs extraction group

In the soft tissue analysis, Incision superius-Labrale superius (Is-Ls) of the mean of

non-extraction group was significantly greater than that of extraction group. There was no significant difference in other items.

## 2. Comparison of post-treatment, non-extraction group vs extraction group

In the skeletal pattern analysis, Frankfort-mandibular plane angle (FMA) of the mean of non-extraction group significantly was greater than that of extraction group. In the dental pattern analysis, Upper incisor axial inclination to the SN plane (U1-SN) of the mean of non-extraction group was significantly greater than that of extraction group.

Frankfort-mandibular incisor angle (FMIA) of the mean of extraction group was significantly greater than that of non-extraction group. In the soft tissue analysis, Labrale superius-Esthetic plane (Ls-E-plane), Lower lip-Esthetic plane (LL-E-plane) and Lower lip-Subnasale-soft tissue pogonion line (LL-Sn-Pg' line) line of the mean of non-extraction group were significantly greater than that of extraction group. In the model analysis, Overbite of the mean of extraction group was significantly greater than that of non-extraction group. In the digital model analysis, Maxillary and mandibular intermolar width of the mean of non-extraction group were significantly greater than that of extraction group. Maxillary and mandibular arch perimeter of the mean of non-extraction group were significantly greater than that of extraction group.

## 【DISCUSSION】

### 1. Comparison of pre-treatment, non-extraction group vs extraction group

In the soft tissue analysis, ls-Ls of the mean of non-extraction group was significantly greater than that of extraction group. This results means that the thickness of the upper lip was large in the non-extraction group. This is the reason why, it is assumed that U1-SN of the mean of non-extraction group was smaller than that of extraction group. Thus, we consider that the labial tipping of the maxillary central incisors result that the upper lip become thin-lipped, in contrast, palatal tipping of the maxillary central incisors result that the upper lip become thick-lipped.

### 2. Comparison of post-treatment, non-extraction group vs extraction group

In the skeletal pattern analysis, FMA of the mean of non-extraction group significantly was greater than that of extraction group. When FMA is high angle, it indicates that the lower facial

height is long. In orthodontic treatment, the Class II elastics are often used regardless of the extraction or non-extraction cases. The purpose of use of Class II elastics are to obtain optimal occlusion. Whereas, there are also disadvantages such as the molar extrusion and the clockwise rotation of the mandible. This is the reason why, it is assumed that FMA of the mean of non-extraction group significantly was greater than that of extraction group. On the contrary, in extraction group we also predicted the outcomes of Class II effects, however FMA showed a slight decrease. It was reported that the wedge effect was caused by mesial movements of the maxillary and mandibular molars in premolar extraction case and the wedge effect led to the counterclockwise rotation of the mandible. In extraction cases, the wedge effect cancel out the effect of Class II elastics. For this reason, FMA showed a slight decrease. Thus, it is considered that the skeletal vertical control is more important in non-extraction borderline cases. In the dental pattern analysis, U1-SN of the mean of non-extraction group was significantly greater than that of extraction group. This is because the maxillary anterior teeth are inclined on the labial side in the non-extraction group, whereas, the maxillary anterior teeth are inclined on the palatal side in the extraction group. This is the reason why FMIA was significantly smaller than that of the extraction group. In the soft tissue analysis, Ls-E-plane, LL-E-plane and LL-Sn-Pg' line of the mean of non-extraction group were significantly greater than that of extraction group. This is because the maxillary and the mandibular anterior teeth are inclined on the palatal(lingual) side in the extraction group, accordingly the upper and lower lips are retracted. The upper and lower lips position affect facial profile, therefore this might be severely items in extraction and non-extraction borderline case in skeletal Class I malocclusion. In the model analysis, Overbite of the mean of extraction group was significantly greater than that of non-extraction group. This is because the maxillary and the mandibular anterior teeth are inclined on the labial side in the non-extraction group, accordingly, they are intruded relatively. In the digital model analysis, the maxillary and the mandibular intermolar width of the mean of non-extraction group were significantly greater than that of extraction group. This is because the maxillary and the mandibular of the 4 first premolars were moved mesially, palatally and lingually.

## **【CONCLUSION】**

Regarding the selection in terms of extraction or non-extraction decision in extraction and non-extraction borderline case in skeletal Class I malocclusion, we consider the upper and the lower lips retracted and their quantity of change between pre- and post-treatment in extraction case. Simultaneously, we consider the lower lip protruded and it's quantity of change between pre- and post-treatment in non-extraction case. Furthermore, as for the occlusion, extraction and non-extraction cases can achieve optimal occlusion in the end, before finishing active treatment, it was suggested that we objectively evaluated occlusion used ABO-OGS, and we confirmed optimal occlusion in the end.