

## Software aided prediction of the outcome of orthognathic treatment

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### Abstract

**Aim:** Determining the proximity between predictions performed by Dolphin imaging software before and after the orthognathic surgery with standard manual method.

**Methods and Materials:** Twenty longface CI III patients, that had been undergone surgery were selected and their cephalograms and study cast records, before treatment, before surgery and after surgery were evaluated. The outcome was predicted with Dolphin imaging software and with standard manual method, before and after surgery.

**Results:** Differences of the variables by the software prediction in the presurgical and postsurgical stages in comparison with standard prediction method were usually insignificant.

**Conclusions:** Dolphin Imaging software (version 10.0) has a good accuracy for prediction of presurgical and postsurgical outcome of long face CI III orthognathic patients.

**Keywords:** Dolphin imaging software, accuracy, prediction

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The need for orthognathic surgery to correct skeletal and occlusal deformities is increasing, because recently, more adult people are willing to do orthodontic treatments.<sup>1</sup> Prediction of the outcome of an orthognathic surgery is very important in treatment of these deformities, which has usually been performed by manual tracings. Recently technological advances induced computer usage in planning and prediction of the outcome of orthognathic surgery treatments.<sup>1</sup>

Several investigations has been performed to compare the accuracy of manual and software-aided predictions.<sup>2-12</sup> The aim of this study was to determine the proximity between predictions performed with Dolphin imaging software (version 10.0) and the standard manual method before and after the surgery.

### Methods and Materials

Twenty long-face class III patients undergone orthognathic surgery were selected. Cephalometric and dental cast records were evaluated before treatment, before and after surgery. Dental casts of each patient were articulated. Occlusogram of upper and lower arches were drawn.(Fig 1,2) Based on TSALD and transferring upper and lower occlusograms to the initial cephalometric tracing, following correction of the inclination of the upper and

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lower incisors, the total space analysis was achieved. The norms of upper and lower incisor inclination were regarded as 105 and 90. (Fig 3) To select the appropriate treatment planning for the upper and lower arch, the following points were considered:

If Space Discrepancy (SD) was more than 8 mm, ext. would be selected.

If SD was between 4 and 8, ext. and nonext. would be selected.

If SD was less than 4 mm, nonext. would be selected.

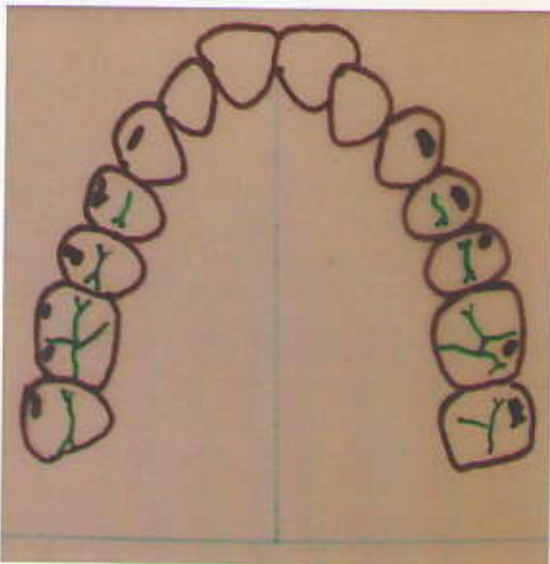


Fig 1: occlusogram of the upper arch

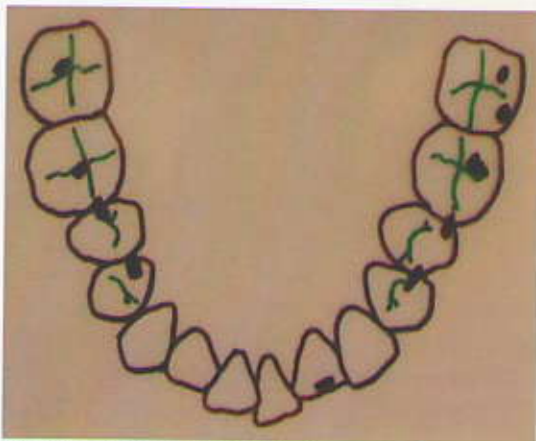


Fig 2: occlusogram of the lower arch

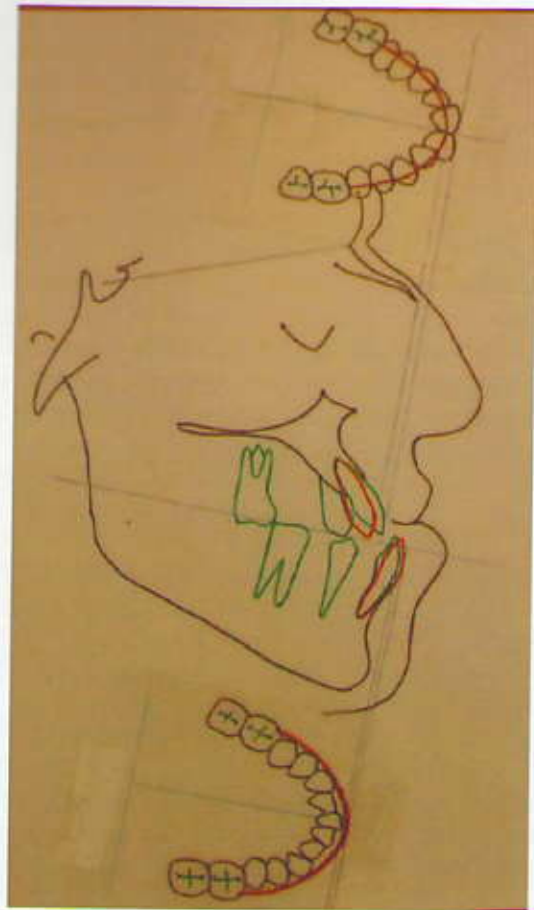


Fig 3: correction of upper and lower incisor inclinations

In this example, upper SD and lower SD were 6 mm and 4 mm respectively. So two treatment planning (ext., nonext.) were conducted for the upper arch and the best plan would have been selected based on the final post-surgical profile. (Fig 5) In this case, non-extraction plan was selected for the upper and lower arch.

On the maxillary and mandibular tracings, there were landmarks to evaluate two dimensional movements of the jaws during manual prediction. (Figure 4)

Measurements from manual tracing were entered to the treatment panel to predict pre-surgical and post-surgical outcome with Dolphin imaging software.(Figures 5,6)

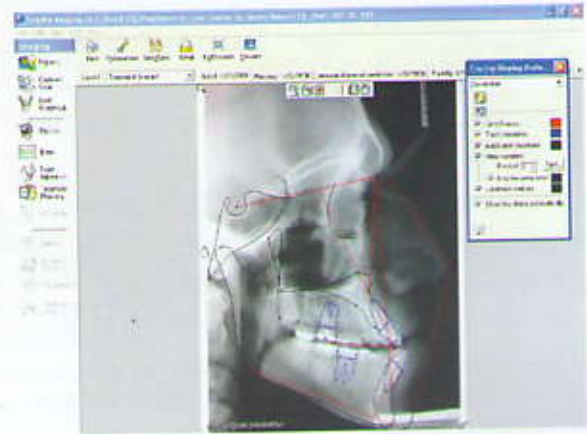
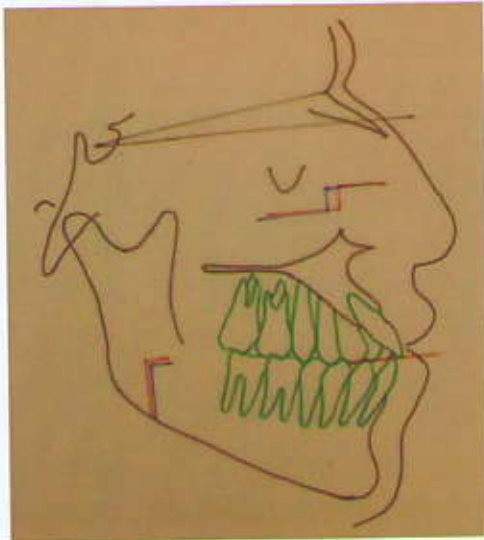


Fig 5 : Pre-surgical software prediction

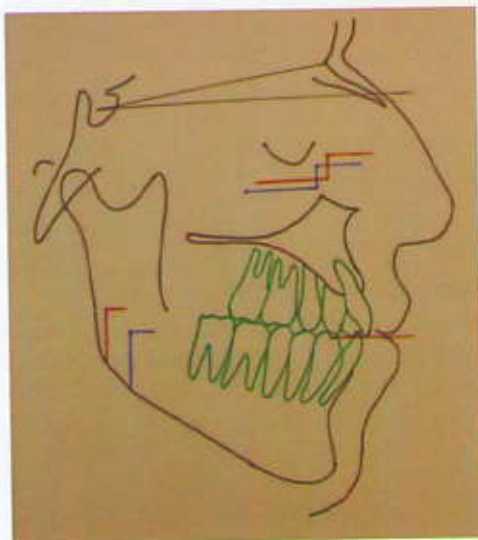


Fig 6 : Post-surgical software prediction

Fig 4: Based on postsurgical predicted profile, nonext. plan was selected for the upper arch in this case.

Based on literature review, the manual method was accepted as golden standard.<sup>1, 3, 6</sup> For every patient, in the pre-surgical and post-surgical stages, the correlation between manual and software-aided predictions were determined, respectively.

Measurements calculated for the predictions before and after the surgery were:

Angular measurements:

SNA, SNB, ANB, PP/FH, MeGo/FH, U1 to SN, L1 to MEGO

Linear measurements:

A to N.perp, Pog to N.perp, U1 to A.perp, U1 to PP, U6 to PP, L1 to MeGo, L6 to MeGo For these comparisons, the paired t-test was computed.

### Results

**Comparison between manual and software aided prediction of presurgical outcome:**

All variables were not statistically significant

**Comparison between manual and software aided prediction of postsurgical outcome:**

Except for SNA, U1/A.Perp. and L6 to MeGo, other variables were not statistically significant

### Discussion

The data for prediction of pre-surgical and post-surgical outcome was achieved from the manual prediction method, so the manual and software-aided prediction were not significantly different in pre-surgical stage and a lot of variables in the post-surgical stage. Gosset et al<sup>1</sup> and Eckhardt, Cunningham<sup>6</sup> in their studies found similarity between manual and software method for the prediction of post-surgical outcome.

In addition to difficulty in locating A point, according to Loh et al<sup>12</sup>, positioning the apex of upper incisors in the cephalometric view is not so easy, therefore; there was significant difference for the SNA and U1/A.perp. measurements in post-surgical comparisons.

### Conclusion

Dolphin Imaging software (version 10.0) has a good accuracy ( $p < 0.05$ ) for prediction of pre-surgical and post-surgical outcome of long face C1 III orthognathic patients.

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