On prediction in orthognathic surgery

Analysis of 2D and 3D techniques from multiple perspectives

Akademisk avhandling

Som för avläggande av Medicine doktorsexamen vid Sahlgrenska akademin, Göteborgs Universitet kommer att offentligen försvaras i Arvid Carlsson salen, Medicinaregatan 3, Göteborg, torsdagen den 15 mars 2018, kl. 9.00

av Martin Bengtsson

Fakultetsopponent:

Docent Anders Westermark

Kirurgkliniken, Mariehamn, Finland

Avhandlingen baseras på följande delarbeten

I. Bengtsson M, Wall G, Miranda-Burgos P, Rasmusson L. Treatment outcome in orthognathic surgery - A prospective comparison of accuracy in computer assisted two and three-dimensional prediction techniques. J Craniomaxillofac Surg 2017. DOI 10.1016/j.jcms.2017.01.035

II. Bengtsson M, Wall G, Greiff L, Rasmusson L. Treatment outcome in orthognathic surgery - a prospective randomized blinded case-controlled comparison of planning accuracy in computer-assisted two- and three-dimensional planning techniques (part II). J Craniomaxillofac Surg 45 (2017) pp. 1419-1424 DOI 10.1016/j.jcms.2017.07.001

III. Bengtsson M, Wall G, Larsson P, Becktor JP, Rasmusson L. A comparison of treatment outcome of patient reported quality of life in Orthognathic Surgery between computer assisted two and three-dimensional planning techniques: a randomized double-blinded active-controlled clinical trial. Am J Orthod Dentofacial Orthop. Accepted for publication 2017-12-30.

IV. Bengtsson M, Wall G, Becktor JP, Rasmusson L. Treatment outcome in Orthognathic Surgery - a randomized double-blinded active-controlled clinical comparison of cost-effectiveness in computer assisted two- and three-dimensional planning techniques. Submitted.

SAHLGRENSKA AKADEMIN
INSTITUTIONEN FÖR ODONTOLOGI

GÖTEBORGS
UNIVERSITET

On prediction in orthognathic surgery

Analysis of 2D and 3D techniques from multiple perspectives

Martin Bengtsson

Avdelningen för Oral och Maxillofacial kirurgi, Odontologiska institutionen, Sahlgrenska akademin, Göteborgs universitet, Sverige.

Abstract

The aim of the present thesis was to compare two different prediction methods in orthognathic treatment of dentofacial deformities and severe malocclusions. The comparison was made between a two-dimensional (2D) and a three-dimensional (3D) computerized prediction system in 62 healthy subjects with Angle class III occlusion aged between 18-30 years and from different perspectives. Measurements were performed prior to surgery and at 12-month follow-up on cephalometry, health related quality of life (HRQoL), time consumption, economic cost and effective radiation dose. The thesis is based on four articles, which all were conducted as prospective double-blinded two-armed parallel-group randomized controlled trials with a 1:1 allocation ratio. Cephalometric accuracy showed as expected a statistically significant difference between planned and obtained positions for all measurements ($p<0.001$) and revealed a level comparable to other similar studies for both techniques. The 3D technique showed a comparable higher accuracy in the anterior maxilla ($p<0.05$). Both techniques showed poor accuracy in the anterior mandible. Independent on planning technique, 2D or 3D, analysis of HRQoL demonstrated an improvement after treatment of dentofacial deformities and malocclusions with orthognathic surgery. No statistically significant difference was found between the groups ($p>0.21$). An initial difference between the groups in HRQoL was observed. Accounting for that, a statistically significant difference was found for one parameter in the questionnaire ($p=0.028$). Comparing the cost-effectiveness for the two planning techniques showed no difference in time consumption between the techniques ($p>0.30$). The 2D technique showed an overall lower economic cost ($p<0.001$). A larger effective radiation dose related to the 3D planning technique was found ($p<0.001$). The present thesis reveals only minor differences between the studied techniques. Because the 3D technique has an advantage for the group of patients with asymmetry it would be the technique recommended for any case in the clinical setting.

Keywords: Orthognathic surgery, Dentofacial deformity, Three-dimensional, Two-dimensional, Computer-aided surgical simulation, Virtual surgical planning, Prediction, Cephalometry, Randomized controlled trial, Blinded case-controlled cohort study