

**3-D characterization of facial deformities and prediction of facial soft and hard tissue response to orthognathic surgery**

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There is a lack of quantitative data in the scientific literature on the 3-D changes in the facial morphology following orthognathic surgery. The availability of 3-D stereophotography and cone-beam CT (CBCT) has made it possible to capture 3-D images of hard and soft tissues of the face with minimal radiation. The aims of this project are: (1) to characterize the 3-D facial anthropometry and 3-D cephalometry of 6 groups of facial deformities; (2) to evaluate the 3-D facial soft tissue response to hard tissue change following orthognathic surgery; and (3) to quantify osseous movement required to produce the desired soft tissue position for developing 3-D prediction models.

150 patients with 6 common types of facial deformities scheduled for orthognathic surgery will be recruited. CBCT data and 3-D photographs will be acquired preoperatively and 6, 12 and 24-months postoperatively. 3-D virtual models with natural surface texture will be constructed for each patient by combining the CBCT and stereophotographic data. The pre- and post-operative virtual models will be superimposed using the skull base as the reference. The hard and soft tissue changes resulting from surgery will be quantified.

Such contemporary data on 3-D facial soft tissue changes will aid to refine and develop better soft tissue prediction algorithms and software for orthognathic surgery planning. This will help the surgeons to plan the amount and path of osseous movement required to achieve the desired aesthetic outcomes in orthognathic surgery. Different surgical options can be studied in advance and evaluated before the actual operation. The virtual patient models can aid training of residents and permit simulation of new or unconventional osteotomy techniques. The 3-D prediction models will provide better pre-operative information for patients and enhance communication between surgeons and patients.