University of Ferrara

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Molecular medicine and pharmacology

XXX cycle

Coordinator: Prof. Francesco Di Virgilio

"The edentulous posterior ridge: novel diagnostic and therapeutic approaches for bone augmentation"

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ABSTRACT

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BACKROUND

In the international literature a lot of studies analyzed bone volume in different way and in different region. Quirynen et al.(2003) and Tepper et al. (2001) measured the size of the mandible using CT, but these measurements were limited to the interforaminal region. The anterior region of the mandible, even if it was the first area that received osseointegrate dental implant, is not the only one could need implant rehabilitation. In the other hand, the posterior mandibular region is one of the most delicate area to insert an implant caused by the presence of important anatomic limitations (i.e. inferior alveolar canal, undercut in the lingual border). The international literature presented a lot of articles which describes the bone dimensions but the most of analysis is only in a bi-dimensional point of view with panoramic radiographs. An other region of the oral cavity where is difficult to place an implant is the posterior maxillary region. In this area the majority of case needed a bone augmentation procedure, such as sinus lift, because bone height is not sufficient to receive an implant (Pramstraller et al. 2011, Farina et al. 2011). In the international literature different procedures to permit the sinus floor elevation are described. It is well known, thanks to systematic review, the tSFE (transcrestal sinus floor elevation) is better tolerated by patients than the lateral approach. The trend of the medical surgery and in particular the oral surgery is to become minimally invasive. Data about the different perception of patient-reported outcome between implant placement entirely in native bone or concomitantly with tSFE are not still present in the international literature.

GENERAL PURPOSE

To determine the 3D bone size and morphology in the posterior edentulous mandible and the bone volume modification following tooth extraction by using a novel methodology. The other purpose of this PhD thesis is to validate the minimally invasive procedure of the novel therapeutic approach for transcrestal sinus floor elevation (i.e. Smart Lift technique).

SPECIFIC AIMS

I. to evaluate the ridge dimensions of posterior sextant in totally edentulous mandibles by using a novel methodology.

II. to evaluate ridge dimensions at edentulous, mandibular posterior sites and contralateral dentate sites by using the same novel methodology.

III. to evaluate the patient-reported outcomes as well as the type and incidence of complications when implants are placed either concomitantly with a novel tSFE procedure (i.e. Smart Lift) or in native bone.

MATERIALS & METHODS

I. Cone beam computed tomography (CBCT) scans of 136 (69 male and 67 female) patients were retrospectively analyzed by the novel methodology. At sites corresponding to the second premolar (site a) and the mesial and distal root of first molar (sites b and c, respectively), bone height (BH) and bone width (BW) at 1, 3 and 5 mm apically to the most coronal point of the alveolar crest were measured.

II. Computed tomography (CT) scans of 24 subjects were retrospectively analyzed thanks to the same novel methodology. The parameters measured were: bone height (BH), bone width (BW) at 1, 3 and 5 mm apically to the most coronal point of the alveolar crest, relative ridge position (rRP), alveolar canal height (ACH) and basal bone height (BBH). The sites of interest were second premolar, first molar and second molar dentate sites and contralateral edentulous sites.

III. Data were retrospectively obtained from four clinical centers. The principal inclusion criteria was the single-tooth rehabilitation of the posterior maxilla with dental implant. Cases for tSFE group (14 patients) were included if they showed an extent of sinus lift ≥4 mm concomitantly to implant placement. Cases for N group (17 patients) were included when implant placement was performed entirely in native bone. Patient-reported outcomes had been assessed using 100-mm visual analog scales (postoperative pain, VASpain) and visual rating scales (level of discomfort, VRSdiscomfort; willingness to undergo the same surgery, VRSwillingness). The dose of analgesics had been self- recorded.

RESULTS

I. In total edentulous patients: (i) BH significantly decreased from site a (11.20 ± 4.03 mm) to site c (10.28 ± 3.33 mm); (ii) males showed a significantly higher BH compared to females at all sites ($p<0.001$); (iii) no significant impact of age on BH was found; (iv) BW increased from coronal to apical at all sites; (v) at all height levels, BW increased from mesial to distal (BWc>BWb>BWa).

II. When compared to dentate sites, edentulous sites showed: (i) lower BH; (ii) a more apical position of the ridge; (iii) lower BW1mm; (iv) lower ACH; (v) similar BBH. The difference in each radiographic measurement between edentulous and contralateral dentate sites was not significantly different between females and males. The prevalence of edentulous sites with BH≥ 9 mm and BW1mm≥ 6 mm and/or BH≥

11 mm and BW3mm≥ 6 mm was higher in females compared to males at second premolar, while was higher in males compared to females at molar sites

III. The results indicated that (i) the complication of the surgical procedure was limited to one membrane perforation in tSFE group, without compromising the completion of the procedure; (ii) theVASpain remained low (<12) in both groups; (iii) a tendency of VASpain to decrease with time was observed in both groups; (iv) the area under the curve for VASpain (AUCpain), indicating the level of pain experience through the first week following surgery, was 18.0 (IR: 8.5–85.0) and 11.5 (IR: 4.5–18.5) in tSFE and N groups, respectively, with no significant inter-group differences (P = 0.084); (v) tSFE did not determine an increased consumption of analgesics compared to implant placement in native bone; (vi) no significant inter-group difference in VRSdiscomfort and VRSwillingness was observed.

CONCLUSIONS

The current results indicate that:

I. In the posterior edentulous sites of mandibles, mean residual bone height and width showed a decrease and an increase, respectively, in the mesio-distal direction. The dimensional change of the bone height coronal to the inferior alveolar canal (IAC) seems to be the result of apical displacement of the bony crest and the reduction of the lumen of the IAC. The edentulous sites in the posterior mandible show a reduced height and bucco-lingual width of the ridge when compared with contralateral dentate sites.

II. Gender showed a significant impact on bone height, with males having on average a 2.8 mm greater height than females, but not on bone width. Gender seems to have a limited impact on the dynamics of ridge resorption following tooth loss.

III. The novel tSFE (according to the Trombelli et al. 2008, 2010a,b) seems to represent a well-accepted option with a favorable risk-benefit ratio when used concomitantly with implant placement in the atrophic posterior maxilla.

IV. The implant placement performed either concomitantly with novel tSFE or entirely in native bone are associated with limited incidence of complications, low postoperative pain and medication, and are both well tolerated.

PUBLICATIONS RELATED TO THE PhD PROGRAM

I. BRESSAN E, FERRARESE N, **PRAMSTRALLER M**, LOPS D, FARINA R & TOMASI C. Ridge dimensions of the edentulous mandible in posterior sextants: an observational study on cone beam computed tomography radiographs. *Implant Dentistry 2017 Feb;26(1):66-72.*

II. **PRAMSTRALLER M**, SCHINCAGLIA GP, VECCHIATINI R, FARINA R & TROMBELLI L. Alveolar ridge dimensions in mandibular posterior regions: a retrospective comparative study of dentate and edentulous sites using computerized tomography data. *submitted*

III. FRANCESCHETTI G, RIZZI A, MINENNA L, **PRAMSTRALLER M,** TROMBELLI L & FARINA R. Patient-reported outcomes of implant placement performed concomitantly with transcrestal sinus floor elevation or entirely in native bone. *Clinical Oral Implants Research 2017 Feb;28(2):156-162.*