

On minimally invasive approaches to sinus lift procedures

AKADEMISK AVHANDLING

som för avläggande av odontologie doktorsexamen vid Sahlgrenska akademien vid Göteborgs universitet kommer att offentligen försvaras i lecture hall vid Avdelningen för Biomaterialvetenskap, Arvid Wallgrens Backe 20, plan 5, fredagen den 30 november 2012, kl. 13.00 av

Lars-Åke Johansson
leg tandläkare

Fakultetsopponent: Professor Tore Björnland, Avd för oral kirurgi och oral medicin, Oslo Universitet, Norge



UNIVERSITY OF GOTHENBURG

Avhandlingen baseras på följande delarbeten:

- I Johansson L-Å, Isaksson S, Lindh C, Becktor J, Sennerby L.
Maxillary sinus floor augmentation and simultaneous implant placement using locally harvested autogenous bone chips and bone debris: A prospective clinical study.
J Oral Maxillofac Surg 2010; 68:837-844
- II Johansson L-Å, Isaksson S, Adolfsson E, Lindh C, Sennerby L.
Bone regeneration using a hollow hydroxyapatite space-maintaining device for maxillary sinus floor augmentation – A clinical pilot study.
Clin Implant Dent Relat Res 2012; 14:575-584
- III Fornell J, Johansson L-Å, Bolin A, Isaksson S, Sennerby L.
Flapless, CBCT-guided osteotome sinus floor elevation with simultaneous implant installation. I: radiographic examination and surgical technique. A prospective 1-year follow-up.
Clin Oral Implants Res 2012; 23:28-34
- IV Johansson L-Å, Isaksson S, Bryington M, Dahlin C.
Evaluation of bone regeneration after three different lateral sinus lift procedures using micro-computed tomography of retrieved experimental implants and surrounding bone: a clinical, prospective and randomized study.
Int J Oral Maxillofac Implants. Accepted 2012-08-27

On minimally invasive approaches to sinus lift procedures

Lars-Åke Johansson

Abstract

Aims: The overall aim of the present thesis was to evaluate implant survival and bone regeneration after minimally invasive sinus lift procedures.

Material and methods: In *study I*, 61 patients were prospectively evaluated 12 to 60 months after two different methods of locally bone harvesting methods adjacent to the maxillary sinus lift procedure.

In *study II*, spherical, hollow, and perforated hydroxyapatite space-maintaining devices (HSMD) with a diameter of 12 mm were manufactured for this pilot study. Three patients with a residual bone height of 1–2 mm and in need of a sinus augmentation procedure prior to implant installation were selected for the study. In *study III*, 14 consecutive patients in need of maxillary sinus floor augmentation were included. Preoperative CBCT with titanium screwposts as indicators at the intended implant positions was used to visually guide the flapless surgical procedure. Twenty one implants all with a length of 10mm and a diameter of 4.1 and 4.8mm were inserted and followed clinically and with CBCT for 3, 6 and 12 months postoperatively. In *study IV*, 24 consecutive patients were included and provided with 30 sinus lift procedures. Three procedures for lateral sinus lift were used: Lateral sinus lift with replacement of bone window and without bone graft (BW), lateral sinus lift and covering osteotomy site with a collagen membrane and without bone graft (CM) and lateral sinus lift with autogenous bone graft (ABG). Experimental implants were retrieved after 7 months of healing and analyzed by micro-computed tomography (μ CT).

Results: In *study I* the survival rate of implants after a follow-up of 12 to 60 months was 98.8% using locally harvested bone grafts at the site of the maxillary sinus augmentation. There was no significant difference in marginal bone loss on the mesial and distal sides of the implant when baseline to 1-year registration was compared with baseline to final registration. During the same time, graft height decreased significantly on the distal apical side of the implants.

A HSMD used in a two stage sinus lift procedure can produce a void for a blood clot and new bone formation and subsequent implant installation (*study II*).

There was minimal marginal bone loss after flapless, CBCT-guided osteotome sinus floor elevation with simultaneous implant installation during the follow-up verified by CBCT. The implants penetrated on average 4.4mm (SD 2.1mm) into the sinus cavity and the mean bone gain was 3mm (SD 2.1mm) (*study III*).

All three methods for lateral sinus lift surgery in *study IV* were equal when new intra sinus bone formation was compared using data from μ CT. Implants apices were seldom covered with bone at the time of retrieval.

Conclusions: Bone grafts can be locally harvested at the site of the maxillary sinus augmentation procedure to enable placement, successful healing, and loading of 1 to 3 implants (*study I*).

A HSMD used in sinus lift procedures can produce a void for blood clot and new bone formation and subsequent implant installation (*study II*).

Flapless transalveolar sinus lift procedures guided by preoperative CBCT can successfully be used to enable placement, successful healing and loading of one to three implants in residual bone height of 2.6–8.9mm. There was minimal marginal bone loss during the 3–12 months follow-up (*study III*).

With regards to lateral sinus lift procedure, high degree of bone-to-implant contact was found regardless of the surgical technique utilized. With regards to lateral sinus wall formation only the autogenous Bone Graft (ABG) group consistently regenerated a completely ossified bony wall (*study IV*).

Keywords: autogenous bone graft, bone formation, clinical study, cone beam computed tomography, dental implants, flapless surgery, hydroxyapatite, osteotome technique, partially dentate maxillae, sinus lift surgery

ISBN 978-91-628-8520-5

<http://hdl.handle.net/2077/30265>

Correspondens: Maxillofacial Unit, Specialisttandvården, Plan 0, Halland Hospital, S-301 85 Halmstad, Sweden, e-mail: Lars-Ake.Johansson@regionhalland.se