Effect of surgical technique and thread design on implant stability in posterior maxilla. A clinical study using Resonance Frequency Analysis

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Topic: Basic research

Abstract

This clinical study aimed to investigate effect of surgical technique and thread design on stability of implants placed into low-density bone present in the posterior maxilla. Implant stability was estimated using Resonance Frequency Analysis during the12-week follow-up period. Lateral bone condensing technique provides optimal implant stability in low density bone regardless of implant thread design whilst following bone drilling technique, the use of self-tapping implants is highly recommended for improving implant stability.

Background and Aim

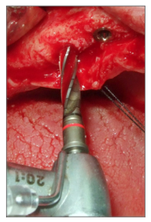
Implant stability, an important prerequisite for successful osseointegration, depends on implant macro and micro design, surgical technique and bone density. Low-density bone offers loose support and in a such condition sufficient implant stability could be achieved using undersized preparation technique, wider implant diameter, placement of conical, self-tapping implants or by condensing of the implant site.

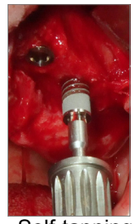
The aim of the study was to investigate mutual effect of surgical technique (lateral condensing vs drilling) and thread design (self-tapping vs non self-tapping) on stability of implants placed in low-density bone of posterior maxilla.

Methods and Materials

- **Inclusion criteria:** bilateral lack of one or more maxillary premolar and/or molar, subantral bone height of ≥12mm, width of the residual alveolar ridge of ≥6.2mm and bone density type 3 or 4 (Lekholm and Zarb).
- **Patients:** 53 generally healthy patients (25 women and 28 men), with an average age of 43.9 years were randomly divided into **4 study groups** according to the implant site preparation technique and implant thread design:
  - **Group 1: Lateral bone condensing and Self-tapping implants**
  - **Group 2: Lateral bone condensing and Non Self-tapping implants**
  - **Group 3: Bone drilling and Self-tapping implants**
  - **Group 4: Bone drilling and Non Self-tapping implants**
- **Implants:** 51 Self-tapping 4x10mm blueSky® (Bredent, Senden Germany) and 51 Non Self tapping 4.1x10mm Standard Plus ® (Institut Straumann AG, Waldenburg, Switzerland) were placed in posterior maxilla.
- **Implant stability measurements:** immediately after implant placement and weekly during the 12-week follow-up period using Resonance Frequency Analysis with an Osstell Mentor® device (OsstellIntegration Diagnostics Savadaled, Sweden).


Lateral bone condensing


Bone drilling


Self-tapping implant placement


Non self-tapping implant placement

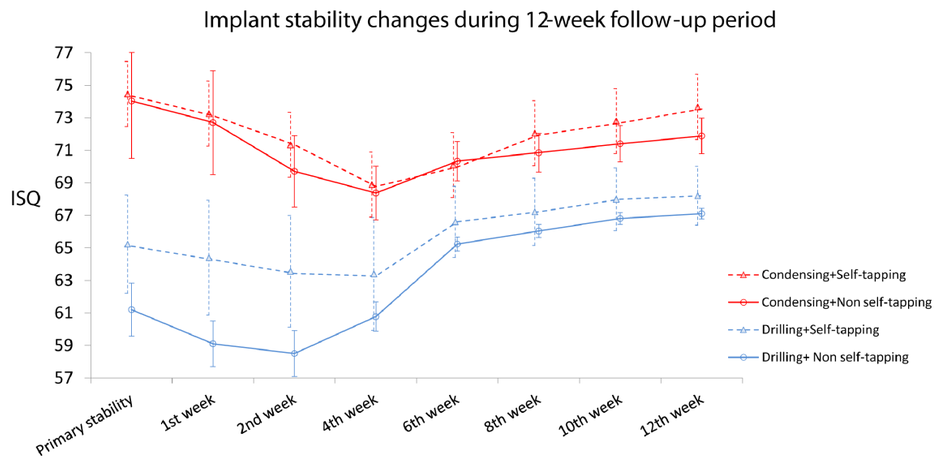
Implant stability measurement

- **Exclusion criterion:** Implants with ISQ < 47 were covered and two-stage protocol was performed.
- **Statistical Analysis:** Descriptives and Mann-Whitney U Test.

Results

- 6 implants were excluded (ISQ 42-46): 2 from group 2 and 4 from group 4.

- Implants placed after lateral bone condensing achieved significantly higher stability during the entire 12-week follow-up period compared with implants placed following bone drilling, regardless of thread design (Mann-Whitney Test, $p<0.05$).
- After lateral bone condensing, self-tapping implants achieved significantly higher stability compared with non self-tapping implants except immediately after placement and in the 1st and 6th week when differences were insignificant (Mann-Whitney Test, $p>0.05$).
- Self-tapping implants placed following bone drilling achieved significantly higher stability compared with non self-tapping implants during the entire follow-up period (Mann-Whitney Test, $p<0.05$).



Conclusions

- **Lateral bone condensing technique provides optimal implant stability in low density bone regardless of implant thread design.**
- **Following bone drilling technique, the use of self-tapping implants is highly recommended for improving implant stability.**

References

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bredent group