Implant stability comparison of immediate and delayed maxillary implant placement by use of resonance frequency analysis – a clinical study

D. Gabrić, D. Katanec, A. Kotarac knežević, I. Filipović zore, V. Vučićević boras, M. Granić, J. Skaricic

Department of Oral Surgery, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

Background: The concept of immediate implant placement has its benefits and risks. Reduction in the number of surgical interventions, shortened treatment time, preservation of bone around the extraction socket, especially preservation of buccal bone, easier and more ideal orientation for implant placement and soft tissue aesthetics have been claimed as the potential advantages of this treatment approach. The main drawbacks of immediate implant placement are lower primary stability of implants compared to implants placed in healed sites and the lack of soft tissue healing with frequent flap dehiscence over extraction sites. Primary stability has been applied as an indicator of future osseointegration and thus long-term success of implant therapy. Since more than a decade, resonance frequency analysis (RFA) has been used as a non-invasive, reliable, easily predictable and objective method for measurement of implant stability. RFA has been widely used to determine loading protocols or assess changes in implant stability over time.

Aim/Hypothesis: The aim of this clinical study was to compare the stability of 30 dental implants placed immediately after tooth extraction with 30 implants placed at healed sites using resonance frequency analysis.

Material and Methods: The study sample consisted of 60 patients, with at least 2 mm of attached keratinized gingiva on the buccal and palatal aspects of the bone. In every patient one Nobel Replace Tapered Groovy Implant (Nobel Biocare, Gothenburg, Sweden) in the maxillary premolar area was inserted. The subjects were divided in two groups, depending on the indication. First group of patients, with clinical indication for immediate implant placement, had 30 implants placed immediately after the tooth extraction. Second group of patients had 30 implants placed in the edentulous maxillary premolar area, four months after tooth extraction. All implants were placed following concept of two stages. After implant placement healing period was 20 weeks and then implants were functionally loaded with single metal-ceramic crown. Follow-up visits were scheduled 1, 2, 6, 12 and 20 weeks after surgery. In this study Osstell Mentor (Integration Diagnostics AB, Goteborg, Sweden), was used for recording Implant Stability Quotient (ISQ) measurement at the time of implant placement (T1) and before loading (T2) after 20 weeks of dental implant placement, for both clinical groups. The manufacturer's guidelines for SmartPeg placement were followed. Due to more precise measurements, SmartPeg was replaced after every 10 measurements. Four different measurements were taken for each implant and averaged to yield the mean ISQ value.

Results: No implant failures were reported in the follow-up period of 6 months. The mean ISQ values for immediate implant placement was 61.43 (standard deviation, SD 1.65; range ± 7) for T1 and 66.23 (SD 1.81; range ± 6) for T2 respectively. Implant placed in the healed edentulous sites showed higher ISQ values compared to immediate implant placement. These implants had ISQ averages of 64.17 (SD 1.74; range ± 8) for T1 and 68.83 (SD 1.89; range ± 9) for T2. These differences in mean ISQ values were statistically significant ($P < 0.001$). Average ISQ in 20 weeks follow-up raised 4.8 for immediate when compared to 4.67 for delayed sites.

Conclusions and Clinical Implications: Although mean ISQ values of immediately placed implants were lower than delayed group, all ISQ values raised to clinically successful value before implant loading. There were no significant differences between stability of implants placed immediately compared to the delayed group. As there were no implant failures in the follow up period, results of this study support the concept of immediate implant placement following tooth extraction under favourable conditions with delayed implant loading.