Purpose: To estimate implant survival and peri-implant bone resorption around long vs normal-length implants in full-arch immediate loading rehabilitation of maxillary arches of low bone quality (D4). Materials and Methods: A total of 45 patients received two mesial normal-length (10 to 15 mm) or longer (18 to 20 mm) implants and two long (18 to 20 mm) distally tilted implants. Differences in bone resorption at 24 months were assessed using the Mann-Whitney U Test. Results: At the 24-month follow-up, no significant differences were found in survival (global cumulative survival rate: 98.9%) or bone resorption (mean: 1.1 mm) between long and normal implants ($P = .053$). Conclusion: At 24 months, the use of long implants provides favorable survival and bone maintenance results in the immediate loading rehabilitation of low-quality maxillary arches. Int J Prosthodont 2018;31:580–583. doi: 10.11607/ijp.5756

Implant rehabilitation with full-arch immediate loading is a widespread procedure for treating patients with an edentulous maxilla or with seriously compromised teeth in the maxilla.1-3 Low bone quality could represent a limit to implant rehabilitation; for this reason, long implants (possibly tilted in the posterior zone to avoid a sinus lifting procedure) could be used to increase the primary stability, to obtain a potential bicortical stability, and to bypass the dental alveolus of postextraction sites.

The aim of the present preliminary report was to estimate the survival rate and peri-implant bone resorption over time of long implants (18 to 20 mm) and normal-length implants (10 to 15 mm) in full-arch immediate loading rehabilitation of edentulous maxillary arches of low bone quality.

Materials and Methods

The present preliminary report was conducted in accordance with the Helsinki Declaration and was approved by the local Scientific Ethical Committee of the University of Genoa. Between May and September 2014, a convenience sample of 45 patients referred to the Division of Implant and Prosthetic Dentistry of Genoa University was enrolled. Patients were in good medical condition with unfavorable prognoses for their residual maxillary dentitions. The unfavorable prognoses were attributed to periodontal disease ($n = 18$), endodontic failures ($n = 9$), dental caries ($n = 11$), or a combination of these factors. Before implant insertion, patients underwent scaling, root planing, oral hygiene instruction, or any periodontal treatment necessary to provide an oral environment more favorable to wound healing. Inclusion and exclusion criteria are reported in Table 1.

A cone beam scan (GXCB-500 Gendex Dental System) was used to select implant sites, plan implant insertion, and analyze bone quality of the selected sites.4 All patients were treated by the same clinicians (T.T., F.P., P.P.) according to the Columbus Bridge Protocol, as described in previously published papers.3,5 At least four external hexagon implants with a 4-mm diameter were inserted: two 10- to 15-mm implants (Full Osseotite NT implants, Biomet 3i) or longer implants (18 to 20 mm) in the anterior maxilla, and two 18- to 20-mm (Biomet 3i) tilted implants in the posterior maxilla (Figs 1 and 2).

Assessment

Intraoral periapical films were accomplished to assess interproximal bone levels at prosthesis placement ($T_0$) and at the 24-month follow-up appointment ($T_1$). Radiographs were obtained using the parallel long-cone technique. The implant-abutment interface was used as a reference point for bone level changes.
measurements, as shown in Fig 3. Two examiners (P.P. and D.B.) performed the clinical measurements after a calibration exercise, demonstrating 95.7% concordance within ±0.5 mm for measurements.

**Statistical Analyses**

Differences in the absolute changes of bone resorption (T1 - T0) between side (mesial vs distal), length (normal vs long), and position (all anterior vs all posterior) of implants were assessed by performing Mann-Whitney U Test. \( P \leq .05 \) was considered statistically significant.

**Results**

A total of 45 patients (26 men, 19 women) with a mean age of 64 years (range: 41 to 91) were included, and 186 dental implants (143 long implants, 43 normal implants) were inserted and evaluated over a 24-month period.

Of the 186 implants, 95 were anterior and 91 posterior. All posterior implants were long (100.0%), while 43 of the anterior ones (45.3%) were normal and 52 were long (54.7%). A statistically significant relationship was found between site (anterior or posterior) and type of implants (long or normal).

After 1 month, two patients lost one distal long implant (18 mm) each. At 24 months, the cumulative survival rate (CSR) was 100% for normal implants and 98.5% for long implants. The global CSR was 98.9%.

No significant differences in bone loss over time were found between the two implant sides (mesial vs distal) \( (P = .68) \) (Table 2), nor between long and normal implants \( (P = .053) \) (Table 3). A statistically significant difference \( (P = .011) \) between anterior and posterior implant sites was found (Table 4), with greater bone resorption next to the anterior implants compared to the posterior ones \( (\Delta = 0.1 \text{ mm}) \).
Based on the present study results, long implants placed in low-quality bone demonstrated favorable CSRs and bone maintenance in full-arch immediate loading rehabilitations after 24 months of follow-up. Overall bone resorption at $T_1$ was 0.8 mm (0.7 mm for long implants and 1.2 mm for normal implants). A statistically significant difference in bone resorption was found between anterior and posterior implants, but the difference in mean bone resorption was 0.1 mm. Such a small difference might be considered statistically but not clinically significant.

Compared to a 15-mm implant, implants of 20- and 18-mm length present an increase in surface area of approximately 33% and 20%, respectively, thus increasing bone-implant contact and primary stability, especially in soft bone. Moreover, in cases of immediate loading in postextraction sites, long implants could facilitate an increase in primary stability, bypassing postextraction sites, the apex reaches the denser residual bone of the premaxilla and allows potential bicortical stabilization.

Some limits of the present research must be acknowledged. This study was not a randomized clinical trial, and long implants were mainly tilted and inserted in the posterior maxilla; therefore, other variables different from implant length may have affected the results. The limited 24-month follow-up assessment qualifies this report as a preliminary one. Consequently, further comprehensive, long-term research outcomes are needed to confirm the merits of the present observations.
Conclusions

At 24 months, the use of long implants provides favorable survival and bone maintenance results in the immediate loading rehabilitation of low-quality maxillary arches.

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The authors declare no conflicts of interest.

References


Literature Abstract

Accuracy of Single Crowns Fabricated from Ultrasound Digital Impressions

This in vitro study aimed to evaluate marginal and internal fit of single crowns produced from high-frequency, ultrasound-based digital impressions of teeth prepared with finish lines covered by porcine gingiva in comparison with those obtained using optical scanners with uncovered finish lines. A total of 10 human teeth were prepared, and 40 zirconia crowns were fabricated from stereolithography (STL) data sets obtained from four dental scanners (n = 10 each): extraoral CS2 (Straumann), intraoral Lava COS (3M), intraoral Trios (3Shape), and extraoral ultrasound scanner. The accuracy of the crowns was compared by evaluating marginal and internal fit by means of the replica technique with measurements in four areas (P1: occlusal surface; P2: transition between occlusal and axial surfaces; P3: middle of axial wall; and P4: marginal gap). Restoration margins were classified according to their mismatch as regular, underextended, or overextended. Kruskal-Wallis one-way analysis of variance and Mann-Whitney U test were used to evaluate the differences between groups at P < 0.05. The median value of marginal gap (P4) for ultrasound (113.87 μm) differed statistically from that of CS2 (39.74 μm), Lava COS (41.98 μm), and Trios (42.07 μm). There were no statistical differences between ultrasound and Lava COS for internal misfit (P1–P3); however, there were statistical differences when compared with the other two scanners (Trios and CS2) at P1 and P2. The ultrasound scanner was able to make digital impressions of prepared teeth through porcine gingiva (P4), but with less accuracy of fit than conventional optical scanners without coverage of the finish lines. Where no gingiva was available (P1–P3), the ultrasound accuracy of fit was similar to that of at least one optical scanner (Lava COS).

Reprints: Juliana Mariotti, jmarotti@ukaachen.de —Carlo Marinello, Switzerland