

Three-Year Evaluation of the Influence of Implant Surfaces on Implant Failure and Peri-implantitis: A Double-Blind Randomized Controlled Trial with Split-Mouth Design

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Purpose: To compare the onset of peri-implantitis, incidence of failure, and peri-implant marginal bone level changes between implants with a roughened surface and those with a machined/turned surface. **Materials and Methods:** All patients needing two dental implants of the same size on the left and right sides of the same arch, and not scheduled for immediate loading, were enrolled between October 2012 and February 2016. The patients were randomly allocated either to Nobel Biocare MkIII or Sweden & Martina Outlink2. Rough-surface implants and machined-surface implants were used from each company. After the preparation of two identical implant sites, each implant (rough or machined of the same group) was randomly allocated to the right and left sides of the same patient, following a split-mouth design. Outcome measures were peri-implantitis onset, incidence of failure, and peri-implant marginal bone level changes. Patients were followed up for 3 years after loading. **Results:** One hundred fourteen patients were enrolled and treated; nine patients dropped out. Following an intent-to-treat analysis to avoid overestimation, proportions are given related to the initial number of 114 patients. Peri-implantitis incidence was 4.39% for machined implants (5/114), 0.88% for rough implants (1/114), 1.75% in the Nobel Biocare group (2 cases), and 3.51% in the Sweden & Martina group (4 cases). The failure rate was 1.75% in machined implants (2/114), 0.88% in rough implants (1/114), 0.98% in the Nobel Biocare group (1/114), and 1.85% in the Sweden & Martina group (1/114). No statistically significant differences in marginal bone loss were found comparing different surfaces, while marginal bone loss was significantly lower in Nobel Biocare than in Sweden & Martina implants. **Conclusion:** Based on the results of this study, no significant differences can be demonstrated in either peri-implantitis or failure rate or in marginal bone loss between rough and machined implants. Marginal bone loss was significantly worse in machined-surface Sweden & Martina than in rough-surface Nobel Biocare implants. *Int J Oral Maxillofac Implants* 2021;36:e23–e30. doi: 10.11607/jomi.8538

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A recent systematic review reported that the rate of peri-implantitis onset in rough-surface implants is higher than that in smooth-surface implants (machined/turned surface). There is some reported evidence suggesting that rough surfaces increase the probability of peri-implantitis by 20%.¹ Over the past 20 years, the use of roughened-surface implants has spread widely in clinical practice because they offer well-demonstrated advantages during the first phase of the implant's osseointegration. In fact, the histologic assessments of animal models^{2–4} and human models^{5–7} in several preclinical studies have demonstrated that in the first 2 months, implants with roughened

surfaces show a significantly higher bone-to-implant contact rate (BIC) than machined-surface implants, which provides evidence of their higher osteoconductive activity. In addition, the removal torque proved to be more significant in roughened implants.⁸ This has made immediate and early loading of dental implants increasingly reliable with considerable advantages for patients, compared with the original Brånemark protocols, which required a 4- to 6-month wait before prosthetic loading.⁶ However, few preclinical studies failed to demonstrate such a difference, since they demonstrated similar BIC and removal torque rates for different implant surfaces, including the machined ones.^{9,10} Another recent study with assessments using electron microscopy reported no differences in the BIC rates between the machined implants and those with oxidized rough surfaces 3 months after surgery.¹¹

In fact, the difference in BIC rates seems to decrease over time, and the difference between the two surfaces in terms of osseointegration seems to be significant in the earlier months. This might suggest that semi-rough implants could be more advantageous in the initial

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