Implant Collar Surface Properties and Marginal Bone Loss

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Simplantology

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Osseointegration is an essential requirement for allowing the survival of dental implants in the jaw bone. Factors such as unfavorable stress distribution, surgical trauma, implant-abutment microgap, and bacterial infiltration can detrimentally affect osseointegration [1, 2] and accelerate bone loss.

According to the literature, most if not all implants will cause to some extent marginal bone Loss (MBL) during their lifetime [3]. Efforts have been made to reduce MBL and to avoid its associated complications. Studies have shown that several factors such as implant surface quality [4] implant neck macro and micro design [5] and crestal implant position [6] play particularly crucial roles in osseointegration.

Surface area may be increased using proper modification techniques, either by addition or subtraction procedures. Surface treatments can also be classified as mechanical, chemical, and physical methods. Surface treatments of dental implants are used to modify their topography and energy, resulting in improved wettability, increased cell proliferation and growth, and in accelerated osseointegration [7].

Alpha-Bio Tec.'s Sand blast Large grit Acid etch (SLA) implant surface is created through two processes: a sand-blasting process for a macro surface of 20-40 microns and a double thermal acid etching process to create micro pitting between 1-5 microns.

There is no consensus in the literature concerning the effectiveness of various implant surface neck configurations and their effect on MBL. The aim of this review is to compare the influence of machined and SLA neck surface on MBL levels during the implant's existence in the bone.

Limited available data suggests that smooth surfaces (machined) are less involved in peri-implantitis than rough surface implants [8]. This observation is potentially supported by reduced plaque accumulation around the implants with a reduced roughness [9]. However, further research has shown that surface porosity impacts on osseointegration by allowing direct 3D ingrowth of osteogenic cells into the implant, thereby strengthening the bone-implant interface [10].

Acid etched surfaces enhance the osseointegration by increasing cell adhesion and bone formation [7]. This hypothesis was demonstrated in in-vitro studies showing osteoblasts growing on SLA surfaces. These osteoblasts are highly differentiated bone cells, suggesting that this pitted surface enhances bone cell-implant integration [11].

Preclinical and clinical studies suggest that there are several factors that individually and cumulatively influence MBL levels. Therefore, studies have been conducted that typically combine two or more crestal neck features to evaluate the best combination of features to reduce MBL.

Certain studies did not confirm that a rough surface combined with a microthreaded neck has a positive effect on the MBL [12]. However, the majority of the reviewed works show a different picture.

Bratu et al. (2009) compared marginal bone loss between implants with SLA treatment and coronal microthreads and polished neck implants. The results showed statistically significant lower MBL in combined SLA/microthread implants.

Another study showed a greater bone loss in implants with a machined surface neck design without microthreads in the first year [9].

The long term study of Piao et al. showed that a rough surface with micro-threads at the coronal part of implant maintained the marginal bone level against functional loading better than implants without these two features after a follow up of one year [13] and confirmed these results after a three year follow up [14].

Additionally, Shin et al. (2006) have shown in their work that a rough surface and micro-threads at the implant neck not only reduce crestal bone loss but also help with early biomechanical adaptation against loading in comparison to the machined neck design. They concluded that a rough surface with microthreads at the implant neck is the most effective design in maintaining the marginal bone level against functional loading [15].

In another study, a correlation between collar design, implant placement and MBL in a canine model was evaluated. The study data showed that the placement of a polished area subcrestally facilitates higher rates of early MBL [6], whereas a rough implant surface placed at the bone level reduces the amount of this bone loss [16, 17].

Conclusions

Based on the reviewed literature, we can conclude that marginal bone changes around rough-surfaced micro-threaded neck implants are significantly lower than in polished or rough surfaced implants.

All Alpha-Bio Tec.'s implants have rough SLA surface and microgrooves which contribute to osseointegration and reduce MBL.

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