Clinical Evaluation of a Laser Microtextured Surface on a Dental Implant

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Objectives: A tapered dental implant (LaserLok™, BioLok Intl., Deerfield Beach, FL) with a controlled microstructure collar was evaluated in a prospective, controlled, multi-center clinical trial. The lower 1.5mm of the collar surface was laser micromachined to produce two zones of microtexture (Figure 1 left). The lower 0.8 mm (bone contacting) region was laser grooved with 12µm wide by 10µm deep grooves that have been previously shown to optimize the surface for bone attachment [1]. The next 0.7 mm of the collar was laser grooved with 8µm wide by 5µm deep grooves that were previously shown to enhance connective tissue attachment [2]. The upper 0.5 mm of the collar, as machined, encourages epithelial tissue colonization. The clinical question addressed by the study is: Can controlled microstructure surfaces be used on dental implants to form stable implant/soft tissue and implant/bone interfaces, thereby reducing crestal bone loss, and maintaining soft tissue architecture.

Methods: Controlled microtexture surfaces were produced using a computer controlled EXIMER laser ablation system to produce the above described microstructure zones (Figure 1 left). In a human clinical trial the LaserLok implants were placed, in pairs, adjacent to machined collar Silhouette™ implants of the same design (control implants) without laser Microtexturing, using a single-stage surgical procedure. Measurement values are reported for: Sulcular Bleeding Index (SBI), Plaque Index (PI), Probing Depth (PD) and Crestal Bone Loss (CBL, radiographic measurement). Data are reported at measurement periods of up to 37 months postoperatively for 20 pairs of implants in 15 patients.

Results: At 37 months, the SBI and PI values were low and comparable for both types of implants. By 37 months the PD values were 3.6±0.49mm (standard deviation) for the control implants, and 2.3±0.44mm for the LaserLok implants, indicating a 1.3mm difference. This difference was 0.6mm at 12 months, increasing to 1.3mm at the latest time period. The soft tissue seal — the 8µm laser microtextured region of the collar — is 0.7mm deep. The probing depth data suggests that an adequate soft tissue seal has been established. There is a dramatic difference between the control and the LaserLok implants in crestal bone retention. By 4 months and at all subsequent time periods, there are significant differences in the two groups. By 14 months, the LaserLok implants demonstrate only a 0.3mm crestal bone loss as opposed to 1.0mm of bone loss with the controls, and at 37 months the experimental implants show 0.59±0.15mm of crestal bone loss while the control implants showed 1.94±0.22mm of bone loss (Figure 1, right).

Conclusion: The LaserLok™ implant utilizes a laser microgrooved collar with two zones for soft tissue and bone attachment. This collar establishes both a soft tissue seal and bone attachment, reduces crestal bone loss to less than 1/3 of that seen in controls, and retains the aesthetics of the soft tissue interdental papilla. It has been shown that, using the controlled microstructure surface produced by laser micromachining, it is possible to engineer a stable "biologic width" around transcutaneous implants.

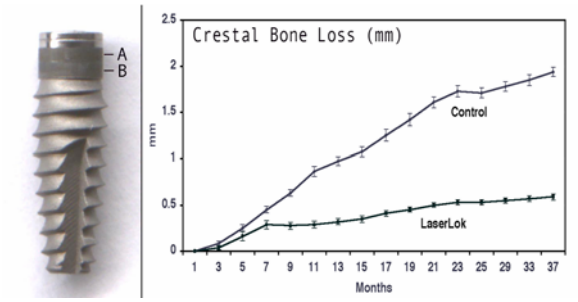

Figure 1. (Left) Photograph of the LaserLok implant showing the laser micromachined collar with a soft tissue attachment zone consisting of 8µm microgrooves (A), and a bone attachment zone consisting of 12µm microgrooves (B). (Right) Graph of crestal bone loss, determined radiographically, showing significant reduction in bone loss by the LaserLok implants relative to the control implants.

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References:

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