Time-Dependent Supraimplant Mucosa Changes: Short Communication

Tim Joda, DMD, MSc[1]

Purpose: *The aim of this short communication was to analyze time-dependent changes of the supraimplant mucosa architecture in the esthetic zone.* ***Materials and Methods:*** *Five patients underwent single-tooth replacement with implant crowns in the anterior maxilla. The supraimplant soft tissue was conditioned with fixed provisional crowns. Quadrantlike digital impressions were taken with an intraoral optical scanning device at three time points: t0, immediately after removal of the provisional (baseline); t1, after 5 minutes; and t2, after 10 minutes. To analyze time-dependent mucosal changes, the corresponding digital files were superimposed for each patient, and baseline (t0) scans were compared with t1 and t2 scans, respectively. Wilcoxon rank sum tests were used for statistical calculations with a strict level of significance at P < .01.* ***Results:*** *Mean values for supraimplant soft tissue changes were statistically significantly different after 5 minutes (5.5%; standard deviation ± 0.3%) in comparison to the results after 10 minutes (21.7%; standard deviation ± 1.8%). The direction of mucosa shrinkage showed a trend toward palatal sites.* ***Conclusion:*** *Based on the findings of this analysis, changes in supraimplant mucosa architecture seem to be affected only slightly during the first 5 minutes after removal of soft tissue support.* Int J Oral Maxillofac Implants 2015;30:619–621. doi: 10.11607/jomi.4105

Key words: *dental implant, intraoral optical scanning, soft tissue, supraimplant mucosa, superimposition*

Single-tooth replacement in the esthetic zone is a major challenge in implant dentistry. Starting with the correct three-dimensional (3D) implant positioning and continuing through surgical placement and prosthetic rehabilitation, all phases of treatment must be planned and carried out precisely to achieve a successful and predictable outcome.[1]

Prosthodontic treatment often includes a sequential provisional phase to individualize the supraimplant mucosa.[2] The sensitive soft tissue requires gentle handling to maintain the defined emergence profile.[3] Conventional as well as digital impression techniques have been adapted to capture the individualized soft tissue information with modified transfer posts[4] or customized scan bodies.[5]

However, no information is available on the extent of supraimplant soft tissue shrinkage over time in the current dental literature. An answer to this question would be beneficial for prosthetic workflows of implant-supported reconstructions in esthetically demanding cases. The aim of this proof-of-principle study was to analyze time-dependent changes of the supraimplant mucosa architecture in the esthetic zone.

MATERIALS AND METHODS

Five patients were selected for single-tooth replacement with implant-supported crowns in the anterior maxilla (Bone Level Crossfit Implants, Institut Straumann). The supraimplant soft tissue was individualized with fixed provisionals to mimic a natural emergence profile. The mucosa height was measured from the implant shoulder to the midline portion of the highest labial aspect with a periodontal probe (UNC-15).

Intraoral optical scanning (IOS) of the implant sites including adjacent teeth was done powder-less with the iTero System (Align Tech Inc) at three time points: t0, immediately after removal of the provisionals (baseline); t1, after 5 minutes; and t2, after 10 minutes. Subsequently, the scan data were stored as digital stereolithographic data sets (three per patient) (Fig 1).

To analyze the time-dependent supraimplant mucosa changes, the corresponding data files from each patient were superimposed with the software Final Surface (version 4.010, Society for the Promotion of Applied Computer Science). The neighboring teeth were

[1]Assistant Professor, Department of Reconstructive Dentistry and Gerodontology, School of Dental Medicine, University of Bern, Switzerland.

Correspondence to: Dr Tim Joda, Department of Reconstructive Dentistry and Gerodontology, School of Dental Medicine, University of Bern, Freiburgstr. 7, 3010 Bern, Switzerland. Fax: +41-31-632-4931.Email: tim.joda@zmk.unibe.ch

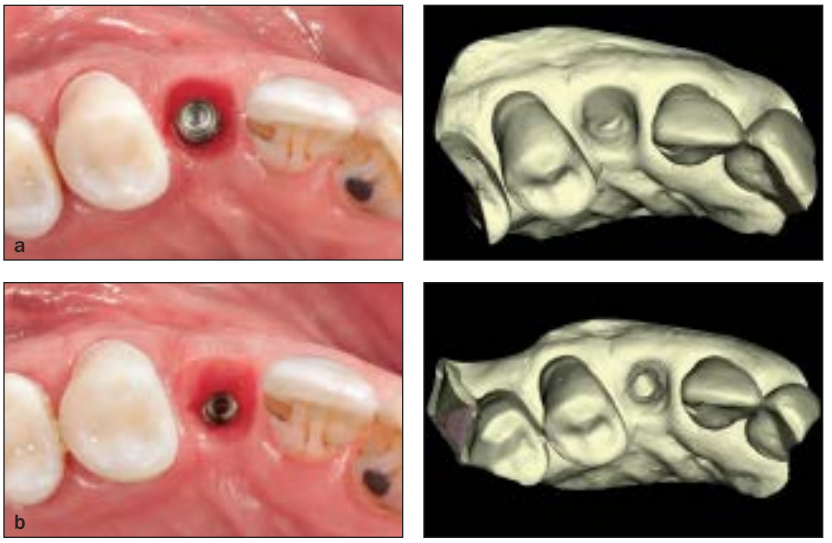

Fig 1 Patient #1. Clinical situation showing the supraimplant emergence profiles as well as corresponding IOS data *(a)* at time point t0, immediately after removal of the provisional, and *(b)* at time point t2, after 10 minutes.

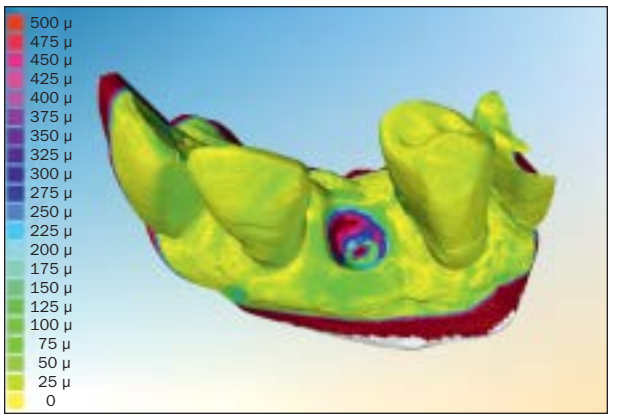

Fig 2 Patient #1. Superimposition of digital files obtained from IOS at time points t0 (baseline) and t2 (10 minutes). Gradients in color display the level and location of supraimplant mucosa changes.

used as stable landmarks to reproducibly superimpose the baseline scans on the t1 and t2 scans (Fig 2).

Statistical calculations were made with R software (version 3.0.2), and Wilcoxon rank sum tests were used for comparisons. A P value < .01 was considered statistically significant.

RESULTS

All interpatient data pairings could be successfully superimposed and examined for analysis. Mean values of supraimplant soft tissue changes revealed statistically significant differences (P < .01) after 5 minutes (5.5%; standard deviation [SD] 0.3%) compared to the results after 10 minutes (21.7%; SD 1.8%) (Table 1). In addition, the direction of mucosa shrinkage was not uniform in the circumference of the emergence profile; instead, it showed a trend toward the palatal (Fig 3).

DISCUSSION

Scientific data investigating time-dependent changes of individually conditioned supraimplant soft tissue architecture for single-unit reconstructions in the esthetic zone are not available in the dental literature. The present analysis revealed the first results on this specific topic; therefore, these data must be interpreted as a preliminary observational trend.

Because this was a proof-of-principle study, the sample size was set relatively low, at n = 5, with a strict level of significance at P < .01. Nonetheless, the results were generally homogenous and exhibited a narrow range of SDs (0.3% and 1.8% at t1 and t2, respectively).

Digital media has become an integral part of dentistry.[6] IOS in particular has provided dentists with the opportunity to capture 3D surfaces as a fast and noninvasive application tool that does not require direct

Table 1 Correlation of Patient-Related Implant Characteristics with Supraimplant Mucosa Changes over Time

Patient	Implant site (FDI no.)	Implant type	Mucosa height (mm)	Mucosa changes (%)	
				After 5 min (t0/t1)	After 10 min (t0/t2)
1	13	RC	4	5.7	20.5
2	11	RC	5	5.4	23.4
3	21	RC	5	6.0	24.2
4	22	NC	6	4.9	19.4
5	11	RC	5	5.3	21.1
Mean			5 (SD 0.6)	5.5 (SD 0.3)*	21.7 (SD 1.8)*

*$P < .01$.
RC = Straumann Bone Level Implants with 4.1-mm Regular Crossfit; NC = Straumann Bone Level Implants with 3.3-mm Narrow Crossfit.

physical contact and does not expose patients to radiation.[7] However, in this context, it should be considered that the accuracy of 3D volumetric measurements has not yet been tested exhaustively.

Finally, it can be assumed, the longer the period of time without mucosa support, the greater the extent of shrinkage. When the selected time points were compared, a significant difference was evident after 5 minutes. However, a precise cutoff beyond this time point cannot yet be clearly estimated.

The direction of mucosa shrinkage seemed to follow the universal principle of conservation of mass. Interestingly, the findings foreshadowed a tendency on the palatal, subsequently, for the direction of the largest volume of soft tissue. From a clinical point of view, this fact may imply that the esthetically important labial region would be more stable during an initial phase without mucosa support.

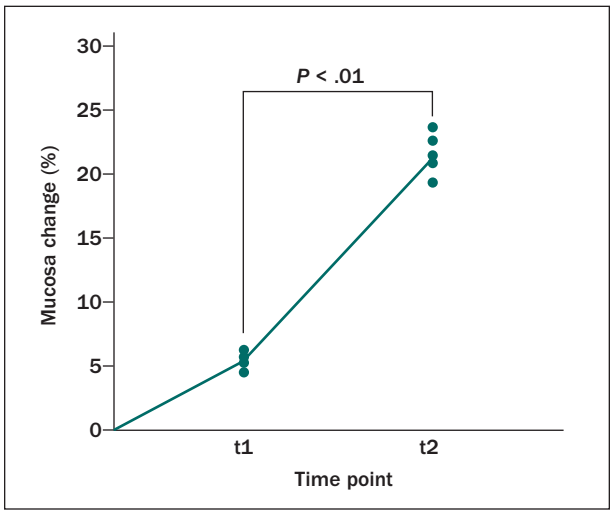

Fig 3 Time-dependent analysis of supraimplant mucosa changes for time points t1 (5 minutes) and t2 (10 minutes).

CONCLUSIONS

Based on these findings and with consideration of the aforementioned limitations, it can be concluded that the supraimplant mucosa seems to be only slightly affected in the initial 5 minutes after removal of prosthetic support. To better determine the clinical relevance of these early results, further large-scale trials are necessary.

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