Immediate Loaded and Unloaded Tapered Screw Implants in the Edentulous Mandible at Second Stage Surgery. An In-Patient-Comparison of 66 Implants for Nine Consecutively Treated Patients.

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Introduction

Several studies have demonstrated that in implant dentistry good clinical results may be achieved with one-stage implant procedures. Recent clinical (Ericsson et al. 2000) and experimental (Piatelly et al. 1998) results have encouraged a progressive shortening of the healing period and immediate loading has been proposed. This method shortens dental rehabilitation time.

The purpose of this study was to find out a protocol for immediate loading and give evidence-based recommendations for rehabilitation of the edentulous mandible by comparing reproducible parameters at immediately loaded and unloaded implants at second stage surgery.

Material and Methods

This prospective study evaluated clinical outcomes of 25 immediately loaded implants compared to 41 unloaded controls in an in-patient comparison in edentulous mandibles. In the course of our investigation 9 patients aged between 50 and 72 (mean 61 ± 8.8) have been treated following an immediate loading protocol so far. In all cases, FRIALIT®-2 stepped screws (**FRIADENT GmbH, Mannheim, Germany**) of different lengths and diameters (Fig. 1,2) were inserted.

The selection of patients for this study was exclusively patient driven by patients declaring the wish or the need of well-retained prostheses in the postoperative phase. Two groups were developed: patients which underwent our routine protocol with four to six implants in the interforaminal region with the goal to treat them with an overdenture on distally extended bars (Group I) and the group of patients who wanted fixed prostheses as definite prosthetic solution (Group II). Thus the immediate loading protocols had to be varied for these two groups according to the modus of definitive prosthesis design (Table 1).

In group I (7 patients, 43 implants) usually six FRIALIT®-2 stepped-screw implants have been placed in the interforaminal region located at position 34, 33, 32, 42, 43, 44. In the course of this study, the stepped-screw type implants were inserted with an increasing torque up to 45 Ncm (Torque-Control, Nobel-Biocare, Gothenburg, Sweden) thus measuring the force to put the implant in final position estimating mechanical bone quality and primary stability. (TC, Table 1). In general the upper rim of the implant has been placed at bone level (Fig. 3). Bone level in relation to implant margin has been measured and recorded with a 1 mm-gauge periodontal probe and has been estimated to 0.5 mm. Four out of six implants have been closed by the cover screw and the mucoperiosteal flap.

In order to obtain an in-patient comparison of immediately loaded and non-loaded implants the ones at 33 and 43 were chosen to be immediately loaded by a Dolder-bar retained overdenture. Both MH-6 and MP abutments (**FRIADENT GmbH, Mannheim, Germany**) have been utilized (Fig. 4). Impressions were made with polyether (Impregum® F polyether-impression material, Espe, Seefeld, Germany) and within a period of 2-4 days a Dolder-bar has been manufactured between these two implants (Fig. 5). Chairside the clip has been polymerised into a provisional overdenture. (Fig. 6).

In group II (2 patients, 23 implants) a fixed immediate prostheses treatment had to be achieved. Implants to be loaded immediately have been determined in advance regardless to their primary stability at the positions 46, 43, 33, 36. The immediate fixed bridgework was manufactured after being mounted in an articulator (SAM, Munich, Germany) on crown abutments (MH-6, **FRIADENT GmbH, Mannheim, Germany**) within four days. Bridgework was then cemented after occlusal adjustment with temporary cement with modifier (Temp Bond, Kerr GmbH, Karlsruhe, Germany). Clinical controls were performed at a three-week interval.

After a delayed healing period of six months second stage was carried out. At this time a full thickness flap was raised exposing the margin of all involved implants in order to collect as much information about marginal bone level of loaded and unloaded implants. The clinical parameters to be evaluated at this point were survival (osseointegration), measurement of periotest-values (PTV) and measurement of marginal bone level related to the level at first stage surgery at loaded and non loaded implants.

After healing of the soft tissues the conventional procedure was resumed by manufacturing distally extended bars (Fig. 7). For the patients of group I overdentures and for the patients in group II fixed bridges have been manufactured.

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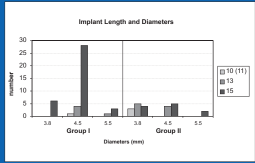

Fig. 1 (left) Distribution of implant lengths and diameters for all implants

Fig. 2 (right) Implant length and diameters in both groups

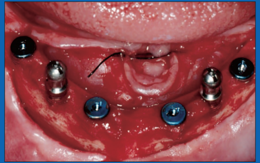

Fig. 3a Six implants placed for retention of an overdenture

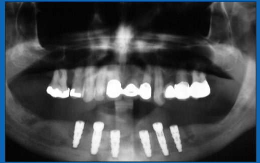

Fig. 3b Postoperative panoramic radiograph of six Frialit-2 implants

Fig. 4: Difference of bone level of immediately loaded (center) and unloaded implants

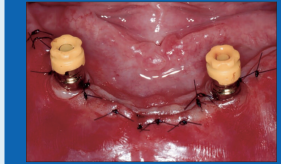

Fig. 4a Immediate loaded implants at time of impressions with MH abutments

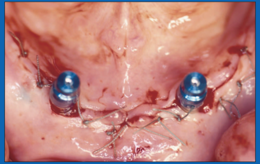

Fig. 4b Immediate loaded implants at time of impressions with MP-abutments

Fig. 5a Healed implant site with MP-abutments

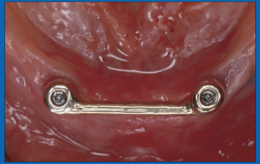

Fig. 5b Healed implant site with anterior Dolder bar

Fig. 6a Provisional overdenture

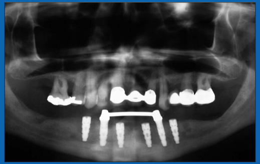

Fig. 6b Radiographic result after 6 months healing period

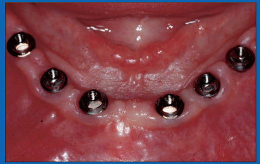

Fig. 7a MP abutments

Fig. 7b Final individually customized bar with distal extensions

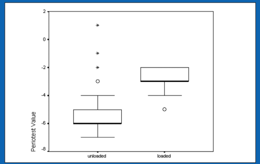

Fig 8 Box-and-Whiskers-Plot for Periotest-values of loaded and unloaded implants

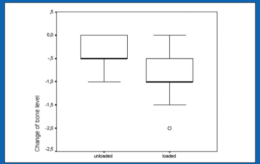

Fig. 9 Box-and-Whiskers-Plot for changes of bone level in loaded and unloaded implants

	Patients	Late-immediate Implants	Late Implants	Loaded Implants	Unloaded Implants	TC 1 >45Ncm	TC 2 >32Ncm	TC 3 >20Ncm
Group I (Bars)	7	12	31	17	26	41	2	0
Group II (Fixed B.)	2	11	12	8	15	12	6	5
Total	9	23	43	25	41	53	8	5

Table 1 Distribution of patients, prosthetic reconstructions (bars, fixed bridges) and implants (loaded, unloaded, late, late-immediate) with torque forces (TC).

		Number	Mean	Standard	Median Deviation	Min.	Max
Implant failures	Loaded Group I Group II Unloaded Total	3 (12%) 0 3 (12%) 1 (2.4%) 4 (6.1%)					
Periotest-value	Loaded Unloaded	22 40	-3.09 -5.0	±0.97 ±1.72	-3 -6	-5 -7	-3 1
Torque at implant placement	Loaded Unloaded	25 41	1.24 1.29	±0.66 ±0.56	1 1	1 1	3 3
Difference of bone level	Loaded Unloaded	22 40	-0.91 -0.34	±0.45 ±0.34	-1 -0.5	-2 -1	0 0

Table 2 Results of measurements six months after implant installation

Results

The results have to be related to the three quoted parameters such as implant survival, periotest-value and clinical bone level change at first stage and second stage surgery (Table 2). The implant failures were highly related to immediate loaded implants (3 of 4 = 75%) with fixed bridgework as provisional prostheses located in posterior (36, 46) tooth positions. All of them were removed at second-stage surgery. No failures have been observed in the group I with the bar-retained overdentures.

It had to be statistically verified whether survival, change of bone level to in relation to implant margin and periotest-values (PTV) did significantly differ between the loaded and the unloaded implants. The median of the periotest-values was -3 for the loaded and -6 for the unloaded implants. A Mann-Whitney-U-test for non-parametric distributed values was applied to compare these values. It showed that the difference is highly significant (p=0,000). That means that the PTV of loaded implants were significantly higher compared to those of unloaded implants, but still in the normal range of well osseointegrated implants (Fig. 8).

The median of bone level changes 6 months post insertion was 1 mm reduction of periimplant bone height for the loaded implants and 0.5 mm reduction for the unloaded implants. The corresponding mean values were 0.9 mm (± 0.45) and 0.34 mm (± 0.34) respectively. The control of significance was achieved the same way as at the periotest-values. With p=0,000 the difference turned out to be highly significant (Fig. 9).

Concerning the Periotest-Value the implants of the group II did have a significantly higher value than in group I (p=0.002, Mann-Whitney-U-test). Engaging the same test the bone level change did not differ significantly (p=0.86) between these two groups.

Though, the influence of primary stability (TC 1-3) on the periotest-value and the survival proved to be highly significant. There was no difference between TC 1 and TC 2 but out of five implants with TC 3 (>20 Ncm) four failed (3 of them loaded ones and one unloaded). The fifth one still in place did have a PTV of +1, showing obviously a lesser degree of osseointegration. The highest impact regarding implant survival was proven for the immediately loaded implants with fixed provisional prostheses.

Discussion and Conclusion

The study design allowed for direct comparison of implant survival and clinical results within the same patients - by direct inspection at the second stage surgery - between immediately loaded and unloaded implants at second stage surgery.

In accordance with other authors we found a significant higher initial bone resorption rate around immediately loaded implants 6 months post insertion. In this patient population, the potential for micromovement was minimized by rigidly splinting implants together with the screw-retained, passive-fitting bar/fixed provisional prostheses.

The technique of bar-retained overdentures using MP-abutments ideally minimised patient management problems and increased patients' acceptance of implant treatment. For the purpose of supporting provisional overdentures, this method has been a viable treatment approach.

According to the outcomes of this study patients can be treated in a highly predictable way with immediately loaded implants in the interforaminal area of the mandible. The technique of bar-retained overdentures described in this paper ideally minimises treatment time and increases patients' acceptance of implant treatment. Future studies will be necessary to evaluate immediate loading protocols in more advanced treatment indications. In spite of the many reports about successful immediate implant loading we still have to accept the fact, that at the present time only non-loading protocols are fully evidenced.

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