Implant-Supporting Telescopic Maxillary Prostheses and Immediate Loading

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ABSTRACT

Immediate loading (IL) in the maxilla is a successful concept when implants are splinted together using a fixed restoration. This concept is associated with high number of implants or difficulties in the plaque control underneath the restoration, which may reduce the patient comfort and satisfaction and compromise the implant prognosis.

Objective: The aim of this study was to evaluate the long-term clinical outcome of implants placed in the maxilla using telescopic-retained removable prostheses under immediate functional loading protocol.

Material and Methods: The present retrospective study included 117 implants with a progressive thread design placed in 26 patients (age 57.04 ± 8.87 years old) with clinical and radiographic evaluation for a period of at least 2 years. A total of 29 implants (24.79%) were placed in fresh extraction sockets. All implants were placed 1–3 mm subcrestally from the mid-facial crest of bone level. The implants were connected immediately after placement with conical prefabricated abutments (4- to 6-degree angle) using a final torque of 15 Ncm immediately after surgery. Secondary prefabricated copings with precise fit for the abutments were placed and the partial dentures were relined chair-side. The restorations were palate-free and were to remain in place without removal for 10 days to splint the implants together.

Results: After a loading period of 54.42 ± 15.68 months (min. 26 months/max. 87 months), the study showed 7 failures (5.98% failure rate), and 10 implants presented a crestal bone loss of more than 2 mm (8.55%). This represented a cumulative survival rate of 94.02% and a success rate for the evaluated implants of 85.47%. All patients were satisfied with the stability of their prostheses and no complications were reported.

Conclusions: Telescopic implant-supported maxillary prostheses in conjunction with IL present an alternative prosthetic solution for the edentulous maxilla, providing long-term predictability and improving the patient comfort and clinical outcome.

KEY WORDS: edentulous, implant, prosthesis, telescopic

INTRODUCTION

For fully or partially edentulous patients in the maxilla or with residual periodontally, severely destroyed maxillary teeth, there is often a need for prosthetic rehabilitation with use of dental implants. The use of telescopic crowns on natural teeth is a well-known treatment option with wide applications and success to support dental prostheses.[1,2]

Different type of attachments, such as bars, magnets, locators, and snap attachments have been suggested to connect dental implants with the overdenture to the implants.[3,4]

Fixed restorations have been reported for rehabilitation of the maxilla using delayed or immediately loaded protocols. However, telescopic type of removable prostheses with immediate loading has been used in the edentulous or partially edentulous mandible.[5–7] Specifically, the entire treatment protocol for the edentulous mandible was described previously by May and Romanos[5] and long-term clinical data was presented by Romanos et al.[6] Based on this protocol in the edentulous mandible, four implants were placed and connected

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DOI 10.1111/cid.12003

with 4- to 6-degree angle, prefabricated, telescopic abutments immediately after insertion.[5,6] The prosthesis was relined using metal prefabricated copings for the telescopic abutments. Using this treatment concept in the mandible, a high survival rate of dental implants has been documented after at least 2 years of loading with a maximum of 129 months of loading period.[6] In a recent paper, the use of this type of telescopic abutments for combined tooth-implant supporting prostheses in conjunction with immediate loading was also described leading to high success rates for the mandibular rehabilitation.[7]

However, there are no edentulous maxilla data using this type of restoration. Therefore, the aim of the present study was to evaluate the long-term success of implants placed in the maxilla and loaded immediately after surgery using a similar protocol with removable, telescopic, implant-supported restorations.

MATERIAL AND METHODS

In a retrospective clinical study, 26 patients (6 male, 20 female; age 57.04 ± 8.87 years) with edentulous maxillae were treated with 117 implants (four to six implants per jaw) and immediate loading between November 2001 and December 2007. Fifteen patients had edentulous maxillae and 11 were partially edentulous in the maxilla. The youngest patient was 40 years old; the oldest one was 70 years old. A total of 29 implants (24.79%) were placed in fresh extraction sockets, immediately after tooth extraction and gentle, meticulous cleaning of the sockets and irrigation with saline solution before implant placement. The size of the implants is presented in Table 1. Implants with the A-label had a 3.5 mm diameter; the B-label had a 4.5 mm diameter. The length of the implants was 9.5 mm, 11 mm, 14 mm, and 17 mm.

All implants were placed 1–3 mm subcrestally from the mid-facial crest of bone according to the chart documentation and loaded immediately after surgery. The implants had a progressive thread design and a sand-blasted, acid-etched surface (Ankylos®, Tulsa, OK, USA). The 2 mm crestal collar of the implants had only etched surface. The implants presented a Morse-tapered (conical) implant–abutment connection (allowing 360 different position options for the abutment) and a platform shifting. According to the manufacturer guidelines, all implants were connected with their conical (straight or angulated) prefabricated abutments (with an angle of 4, 5 or 6 degrees) using a final torque of 15 Ncm.

TABLE 1 Distribution of Implants Placed in the Maxilla

	A9.5	A11	A14	A17	B11	B14	B17
Male	0	5	14	0	6	3	1
Female	1	22	32	1	15	15	2
Total	1	27	46	1	21	18	3

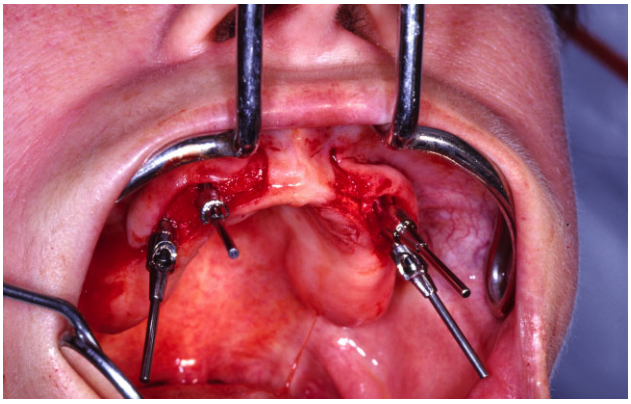

Figure 1 Implant placement and alignment guides in place before alignment.

The abutments (SynCone®, Dentsply, Tulsa, OK, USA) were parallelized each other using special alignment guides (Figures 1 and 2). After flap closure with silk or nylon 4-0 sutures, secondary prefabricated copings were placed over the abutments and the implant-supported overdentures were relined chair-side using methyl methacrylate, cold-cure resin material. The consistency of the resin material should be not very thin but similar to "dough" mixture in order to avoid the flow of the resin in the undercuts. In addition, relining

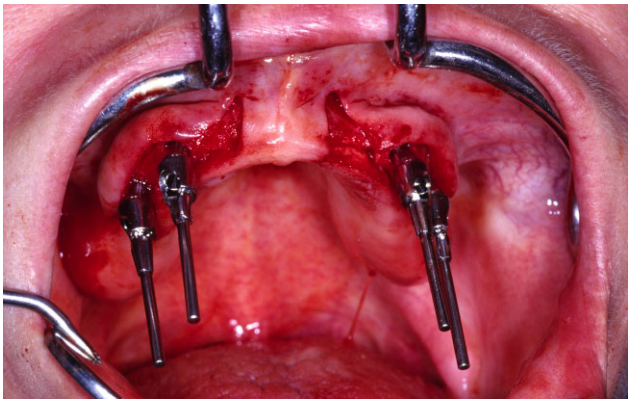

Figure 2 Alignment of the abutments for immediate loading.

Figure 3 Excellent soft tissue healing 1 week after surgery.

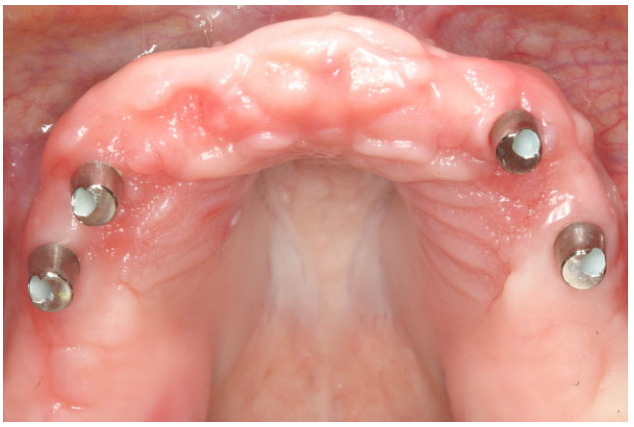

Figure 5 Ten years after loading.

undercuts in the sulcular areas of the abutments were blocked out using a rubber dam of plastic rings placed around the abutments. Patients were advised to close the mouth without pressure during relining. Considering the occlusal vertical dimension according to diagnostic evaluation of the patient before treatment, the final telescopic overdentures were finalized and were implant-supported acrylic prostheses without metal reinforcement. Only cases with metal-reinforced partial dentures, which have been translated to implant-supported prostheses had metal reinforcement.

Antibiotics were prescribed postoperatively for one week, such as wide spectrum penicillin or Clindamycin and Chlorhexidine digluconate mouth rinse was used three times per day. A soft/liquid diet was advised for the first stages of the healing (6 to 8 weeks postoperatively). The patients with implants placed in fresh extraction sockets, had to use soft/liquid diet for 3 to 4 months after surgery. The prosthetic restorations remained in place without removal for the first 10 days in order to immobilize the implants and the sutures were removed after the prosthesis was taken out with a crown remover. All patients had partial (conventional and not implant-supported) or full dentures in the mandible.

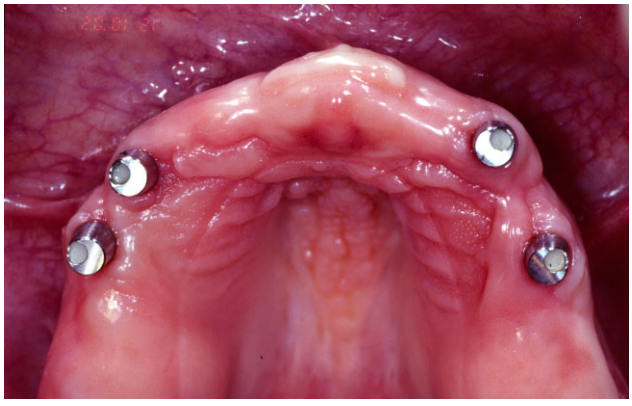

Figure 4 One month healing after immediate loading.

Clinical and radiographic examinations were performed using panoramic radiographs with the same panoramic unit in order to evaluate the condition of peri-implant hard and soft tissues once per year. The implants were evaluated for a period of at least 2 years (Figures 3–5).

The implants were evaluated for stability approximately 3 months after placement. Implants were also assessed for peri-implant soft tissue health, prosthetic stability, prosthetic complications, and radiographic crestal bone loss. Calculations were made of mean survival time, success rate using the Albrektsson et al.[8] criteria, and any other observed complications.

After 1 year, the implants were evaluated annually for mobility, suppuration, and other periodontal conditions, as well as radiographically, determining the crestal bone levels. The radiographs have been evaluated after a magnification of 10× to represent better the crestal bone loss dependent on the implant position at the time of surgery as well as at the follow up visit (Figures 6 and 7). Additional visits initiated by the patients, if and when they noticed problems. A reline of the basis of the prosthesis was performed once per year.

RESULTS

Seven implants failed (5.98% failure rate). This represented a survival rate of 94.02% after a loading period of 54.42 ± 15.68 months (min. 26 months/max. 87 months). The failed implants and the time of failure

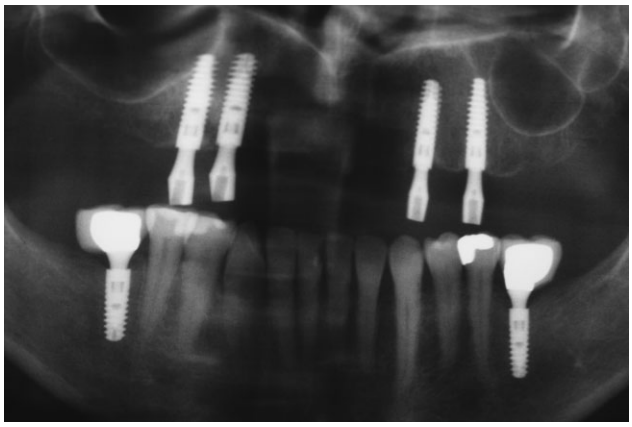

Figure 6 Radiological evaluation 10 years after loading presenting crestal bone stability.

were demonstrated in Table 2. The crestal bone levels showed in general, stability over the entire loading period. Only 10 implants presented a crestal bone loss of more than 2 mm (8.55%). Therefore, the success rate from this retrospective analysis was 85.47%. Specifically, the bone loss in relationship with the number of implants is demonstrated in Table 3.

Patients generally did not complain and were satisfied with the stability of prostheses and there was an absence of complications, such as fracture or insufficient stability of the prostheses. The peri-implant soft tissues presented a healthy condition, without hyperplastic gingival overgrowths and the crest of bone demonstrated long-term stability.

DISCUSSION

Immediate provisionalization of an implant-retained prosthesis following the concept of telescopic restorations was presented here for the rehabilitation of the edentulous maxilla. The present type of prosthesis differs from the implant-supported hybrid restorations or bridges allowing an excellent control of the plaque accumulation. In addition, this type of removable prosthesis is an implant-supported prosthesis and not a tissue-retained restoration like the bar-supported removable prostheses. The possibility to parallelize implants together allows the transfer of the loading forces to the peri-implant tissues, respectively in a similar way like in an implant (and not tissue)-retained prosthesis. The prostheses made did not cover the primary stress bearing areas of the maxilla,[9] but were horseshoe-shaped and restricted to covering the secondary stress bearing area of the residual alveolar ridges. This improved the comfort for the patient and provided a better self-cleaning effect underneath the restoration.

Postoperative complications, such as peri-implant soft tissue overgrowths, were not observed during the entire observation period in comparison to the tissue response around bar-retained prostheses[10] or around snap-attachments.[11]

In the presented concept of maxillary rehabilitation, there is simplicity in the maintenance of the abutment

Figure 7 Restoration 10 years after loading with metal reinforcement.

TABLE 2 Failures in Relationship to the Area and the Loading Period

Area (#)	Loading Period (mo.)	Immediate Implant	Delayed Implant
6	12	x	
6	1		x
5	1		x
5	4		x
11	2		x
12	4		x
12	2		x

TABLE 3 Crestal Bone Loss and Implant Failures

Bone Loss (in mm)	Total Implants
0	33
1	44
2	23
3	10
Failures	7

implants for patients as well as dental hygienists. The double-crown technique represents an ideal type of anchorage in terms of retention.[12–14]

Within the limitations of the study, which is not a randomized clinical trial, but a report of clinical case series with the same treatment, the authors demonstrate the surgical as well as the prosthetic protocol using immediate functional loading for the maxillary rehabilitation. The biomechanical aspects of the telescopic (prefabricated) abutments have been introduced in the treatment of the edentulous mandible in a 2-year follow-up study. Long-term (10-year) data have been evaluated earlier in another group of subjects[5,6] using immediate functional loading protocol. Certainly, limitations of the evaluation of the crestal bone levels have to be considered since the radiographic examination was performed using panoramic and not standardized periapical radiographs. This is a common limitation in most retrospective studies in the daily practice.

The used protocol may be used in the atrophic maxilla but not in cases with extreme atrophy, where surgical interventions and orthognathic surgery is indicated.

The demands on the primary stability and bone retention of the individual implant are increased to prevent any micro-movements under functional loads. The progressive thread design of the used implant system with its rough surface texture seems to be well suited for this purpose. The secondary splinting effect via conical elements rigidly integrated into the denture base is equivalent to primary splinting with a bar, since the precision fit of the machined pair of conical elements results in stable positive seating of the secondary on the primary component. Micro-cracks and micro-movements are prevented by the splinting effect, which results of polymerizing the secondary crowns in the denture base in situ and in its position of maximum intercuspation. The immobilization of the implants in the early healing phase is very important, because the denture acts both as a dressing and a splint for the implants during the first 2 weeks. Also important is a diet that excludes hard foods during this period to limit the functional load.

Considering the age of the patients included in this retrospective evaluation, the present treatment concept may have advantages for patients with complex medical history, who are not able to be treated with high number of implants and may need hospitalization or treatment by the specialist. In addition, the used protocol does not require a high number of implants and only four to six implants are sufficient for the complete rehabilitation of the maxilla. This is an economical benefit for the patient especially for the elderly, who has medical and socio-economical limitations and does need not long visits for the treatment. Our long-term data (mean loading period: 5 years) reported no complications in terms of insufficient stability of the prosthesis with the used prefabricated telescopic anchorage system.

It may be considered that this protocol is an over-treatment for patients with edentulous mandible and full dentures. Patients with edentulous maxillae feel comfortable with the here presented horseshoe-shaped dentures, covering the residual alveolar ridges and improving the patient comfort. However, this treatment concept can be used in patients with implant-supported mandibular two-implant overdentures or five to six implant-retained fixed bridges.

Compared to previously described well-established concepts, such as the 'All-on-four' protocol using tilted implants,[14–18] we were able to present successful results with removable rehabilitation for patients in order to improve quality of life in terms of retention and plaque control. Even the results from the fixed restorations are very promising; the expenses for the restorations are high and there is a risk for need of a new prosthesis in case of implant failure. The advantage of presented protocol here is the option of extension of the prosthesis in case of implant failure, and the placement of another implant in adjacent sites without to increase the cost for the prosthesis.

Immediate loading protocols using the same implant design and fixed restorations have been presented previously, showing high success rates and crestal bone stability, when implants with platform shifting were placed and the abutments were never removed.[19–21] Using similar protocols, the final outcome is very successful as well in patients with history of heavy smoking, since the abutments will be placed on the day of the surgery and they will never be removed.[22] The benefits of the immediate loading protocol as a treatment of choice, reducing in that way the entire treatment period and patient visits,[23,24] does not mean that this kind of abutment cannot be used in the delayed loading protocol. Due to the long-term success of implants loaded delayed or immediately without significant differences in the success rates,[24,25] we consider as a treatment of choice the

immediate loading protocol when basic requirements are met.[20,23,25–29]

A similar treatment protocol with the use of telescopic implant-supported restorations for the maxillary rehabilitation after maxillectomy achieved a sufficient retention and stability of the restoration, when the conventional obturator denture presents difficulties in the retention.[30]

In the present protocol, under a strict selection of patients with good compliance and the minimum requirements of implant length (at least 9.5 mm) and good bone quality, the immediate functional loading in the maxilla using four to six implants and telescopic retained prostheses seems to be successful treatment concept with predictable long-term result. Certainly, such protocols are contraindicated in clinical cases with functional disturbances like bruxers and/or eccentric parafunctional forces.[29] Under these requirements, the present protocol seems to be an alternative method for the rehabilitation of the edentulous maxilla that may be used in the treatment of patients providing economic, technical and clinical benefits.

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