Immediate Loading of Tooth-Implant–Supported Telescopic Mandibular Prostheses

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Purpose: *Extractions in partially edentulous patients often lead to insufficient stability of an existing partial prosthesis and a need for additional anchorage. Implants may therefore be placed as supplementary abutments to increase patient comfort and satisfaction. The aim of this study was to evaluate the long-term clinical outcome of implants combined with teeth to support telescopic abutment–retained removable full-arch prostheses under an immediate functional loading protocol.* ***Materials and Methods:*** *The present retrospective study included implants placed and connected via removable prostheses with periodontally healthy teeth immediately postplacement using prefabricated abutments. Secondary copings, precisely fit to the abutments, were placed and the partial dentures were relined chairside. The prosthetic restorations were not removed for 10 days. Clinical and radiographic evaluations of implants loaded for at least 2 years were performed.* ***Results:*** *One hundred ten implants with a progressive thread design (Ankylos, Dentsply) were placed in 55 patients (mean age, 63.51 ± 9.95 years). Twenty-five implants were placed in fresh extraction sockets (22.73%) and 85 implants were placed in healed ridges. All implants were placed 2 to 3 mm subcrestally (measured from the midfacial bone level). After a mean follow-up of 61.58 ± 28.47 months (range, 24 to 125 months), there were only three failures (2.73%); another six implants (5.45%) displayed crestal bone loss greater than 2 mm but remained stable. Therefore, the failure rate was 8.18% for the entire observation period of 5.13 years. The success rate was 91.82% and the cumulative survival rate was 97.27%. All patients were satisfied with the stability of their prostheses, and no prosthetic, peri-implant, or abutment tooth problems were observed.* ***Conclusions:*** *Telescopic tooth-implant–supported mandibular restorations with immediate loading present an alternative prosthetic solution for partially edentulous patients, providing a long-term predictable clinical outcome.* Int J Oral Maxillofac Implants 2012;27:1534–1540

Key words: *dental implants, partial edentulism, prosthesis, telescopic attachments*

Partially edentulous patients with residual periodontally healthy teeth and removable partial prostheses often need dental implants as abutments to improve anchorage of their prostheses. In partially edentulous patients with few residual teeth, prosthetic problems may occur with keeping the remaining dentition and combining those teeth with implants for support. Although tooth-implant–supported fixed restorations are generally successful,[1] a number of implants may be needed as supplementary abutments for a full-arch prosthetic rehabilitation. In addition, combined therapies, such as the use of locator and/or ball attachments, may combine tissue-supported with tooth-supported restorations. There are no long-term studies evaluating such treatment concepts; nevertheless, for unsplinted implants, the most commonly used attachment is the ball attachment, while magnets are used only rarely.[2–4]

In a previous clinical study, May and Romanos[5] reported on the use of telescopic abutments for implant restorations in the mandible in conjunction with immediate functional loading to increase the stability of full-arch dentures. Four implants were placed and connected with 4-degree prefabricated telescopic abutments immediately after insertion.[5,6] The prosthesis was relined using metal prefabricated copings for the telescopic abutments. With this treatment concept in the mandible, researchers have documented a dental implant success rate of 94.06% after at least 2 years of loading, with a maximum of 129 months.[7] The aim of the present study was to evaluate the long-term survival rate of implants placed in the mandible as supplemental abutments and loaded in combination with residual teeth using the immediate loading concept and a full-arch removable mandibular prosthesis.

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Fig 1 Clinical situation immediately after tooth extraction.

Fig 2 Clinical situation after implant placement, abutment connection, and flap closure.

MATERIALS AND METHODS

The present retrospective clinical study documents the clinical and radiologic follow-up of implants placed in the mandible and loaded for a period of at least 2 years. The implants were placed and connected to removable full-arch prostheses supported by periodontally healthy teeth immediately after implant placement using prefabricated abutments.

Specifically, all patients had residual teeth in the mandible without periodontal disease; the remaining teeth had reduced attachment loss and reduced periodontal support but no signs of periodontal disease or mobility. The mandibular prosthesis was a tooth-supported removable partial denture or a telescopic restoration. Some residual teeth had to be extracted because of deep caries lesions, insufficient periodontal support with progressive mobility, or endodontic failures. Implants were planned to be placed as supplementary abutments to increase the retention of the existing denture. The patients were classified as Kennedy Class 1 cases with bilateral edentulous posterior areas and additional edentulous spaces in the anterior zone, especially after loss of some of the residual teeth.

Implant Placement and Prosthetic Protocol

All implants had a progressive thread design and a sandblasted, acid-etched surface (Ankylos, Dentsply). The 2-mm crestal collar of the implants had an etched surface. The implants had a Morse taper (conical) implant-abutment connection and platform shifting. All implants were placed 2 to 3 mm subcrestally (measured from the midfacial crest of bone) and loaded immediately after surgery. According to the manufacturer's 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, and the conical implant-abutment connection allowed 360 different position options. The abutments (SynCone, Dentsply) were set parallel to the residual teeth using special alignment guides (SynCone System, Dentsply). To ensure parallel positioning of the alignment guides, acrylic resin jigs for the residual teeth were prepared in the lab using a parallelometer and study casts. A guide pin gave the correct direction for osteotomy preparation and implant placement. Finally, the flap was closed with silk or nylon 4–0 sutures (Figs 1 and 2).

Secondary prefabricated copings were placed over the abutments, and the removable prostheses were relined chairside with cold-curing acrylic resin. In cases of multiple tooth extractions, the dentures were relined, with special care taken to avoid deep impaction of the acrylic resin into the extraction sockets. Undercuts in the sulcular areas were blocked using rubber dam or plastic rings placed around the abutments. During relining, the patients were advised to close the mouth without pressure. The patients remained seated during the relining process.

Postoperative Care and Instructions

Antibiotics, such as wide-spectrum penicillin or clindamycin, were prescribed postoperatively for 1 week, and chlorhexidine digluconate mouth rinse was used three times per day. A soft/liquid diet was advised for the first stages of the healing process (6 to 8 weeks postoperatively). Patients who had received implants immediately postextraction had to adhere to a soft/liquid diet for 3 to 4 months after surgery. The prosthetic restorations remained in place for 10 days postsurgery to immobilize the implants. The prostheses were then taken out using a crown remover (Fig 3) and the sutures were removed. All patients had maxillary partial or full-arch dentures.

Follow-up

The protocol for this concept was described previously by May and Romanos.[5] The implants were evaluated

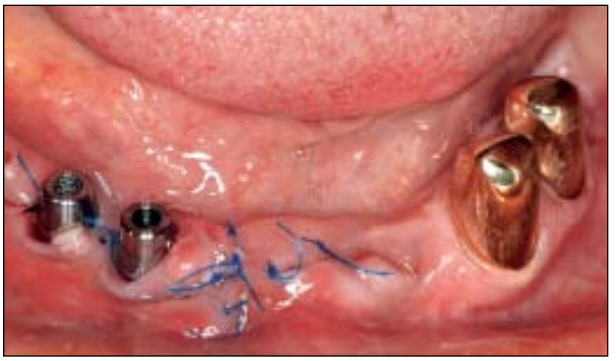

Fig 3 Clinical situation 10 days postoperatively, immediately before suture removal.

Table 1 Age Distribution of the Patients Included in the Study

Patients	n	Mean age (y)	Age range (y)
Total	55	63.51 ± 9.95	40–84
Women	35	62.03 ± 8.67	40–84
Men	20	66.1 ± 10.44	51–80

Table 2 Sizes of the Implants Included in the Study

Diameter × length (mm)	Men	Women	Total	Immediate
3.5 × 9.5	1	2	3	
3.5 × 11	6	6	12	1
3.5 × 14	12	36	48	3
3.5 × 17	0	3	3	
4.5 × 11	0	3	3	2
4.5 × 14	13	14	27	12
4.5 × 17	5	3	8	4
5.5 × 11	2	1	3	
5.5 × 17	0	2	2	2
6.5 × 14	1	0	1	1

for stability using the Periotest device approximately 3 months after placement. Implants were also assessed for peri-implant soft tissue health, prosthetic stability, prosthetic complications, and radiographic crestal bone loss. Mean survival time, success rate using the Albrektsson et al8 criteria, and any other observed complications were also recorded. The comfort of the patient with the retention of the prosthesis was the main criterion for success. Complications, such as fractures of the denture, mobility of the primary or secondary copings, insufficient retention of the restoration, increased mobility of residual teeth, or pain, were evaluated.

After 1 year, the implants were evaluated every year for mobility, suppuration, and other periodontal conditions (eg, gingival overgrowth). Implants were also evaluated radiographically to determine the crestal bone levels. The radiographs were evaluated at 10× magnification to visualize the crestal bone loss around the implants at surgery and at the follow-up visit. Additional visits were initiated by the patients if they noticed problems or discomfort. The patients followed a strict 6-month follow-up program for tooth cleaning and potential relining of both prostheses.

RESULTS

A total of 110 implants were placed in 55 patients (mean age, 63.51 ± 9.95 years) and evaluated clinically and radiographically for a period of at least 2 years. Twenty men and 35 women were included in this study (Table 1). Twenty-five implants (22.73%; 7 in men, 18 in women) were placed in fresh immediate extraction sockets (immediate implants) in areas of extracted canines and first and second premolars (Tables 2 and 3). The remaining 85 implants were inserted into healed mandibular ridges after midcrestal incisions and elevation of a mucoperiosteal flap. The lengths and diameters of the implants placed are presented in Table 2.

The implants were evaluated clinically after a mean of 61.58 months (range, 24 to 125 months). The prostheses in the maxilla and mandible were still in use, and the natural teeth acted as supplemental abutments for the mandibular prosthesis. Twenty-two patients had two natural teeth, 2 patients had three natural abutments, and 25 patients had one natural tooth supporting the prosthesis. Only three implants (2.73%) failed clinically. Six implants (5.45%) had crestal bone loss greater than 2 mm but remained stable and were therefore characterized as radiographic failures (Table 3). The clinically failed implants were mobile within the first 2 months after placement/loading. Two were 14 mm long (one 3.5 mm and the other 4.5 mm in diameter) and one was 17 mm long and 4.5 mm in diameter. All the failed implants had been placed in healed ridges and not in fresh extraction sockets. One implant was in the canine region and two were in first premolar sites. None of these failures were implants placed in the most distal positions.

The implant protocol as a method of rehabilitation in the mandible achieved a success rate of 91.82% over the observation period (survival rate: 97.27%). Patients generally expressed satisfaction (no discomfort) with the stability of the original prostheses, and there were no complaints, such as fracture or insufficient stability

Table 3 Distribution of Failure Rates and Observation Time in Different Patient Groups

Group/time	Men	Women	Total
Total	40	70	110
Immediate implants	7 (17.5%)	18 (25.71%)	25 (22.73%)
Failures			
Clinical	1 (2.5%)	2 (2.86%)	3 (2.73%)
Radiographic	2 (5%)	4 (5.71%)	6 (5.45%)
Total	3 (7.5%)	6 (8.57%)	9 (8.18%)
Observation time (mo)			
Mean	68.1 ± 28.37	57.86 ± 28.18	61.58 ± 28.47
Min	27	24	24
Max	125	119	125

Fig 4 Clinical condition 5.5 years after immediate loading. Excellent health of the peri-implant soft tissues and the periodontal tissues around the remaining teeth is apparent.

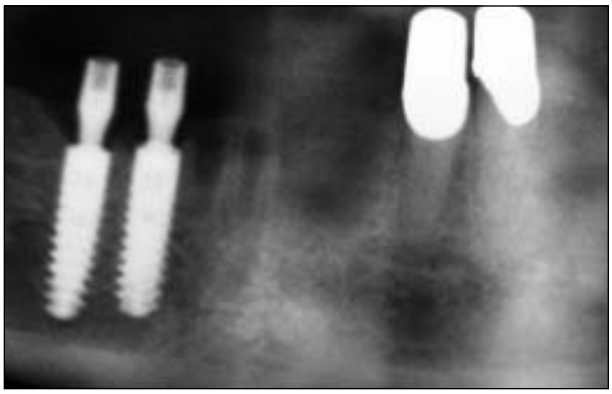

Fig 5 Postoperative radiograph (immediately after surgery) shows the implants with the telescopic abutments attached and ready for immediate loading.

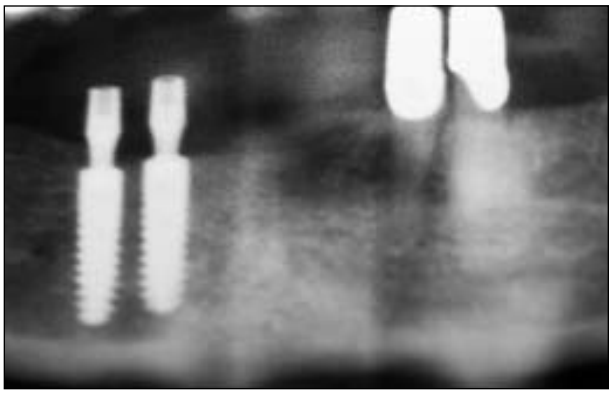

Fig 6 Radiographic examination 5.5 years after loading shows crestal bone stability as well as bone growth over the top of the implant platform (etched surface) in conjunction with platform switching. The abutments were never removed.

of the prostheses. The peri-implant soft tissues were in excellent condition and the crestal bone demonstrated long-term stability (Figs 4 to 8). No residual teeth showed increased mobility at the last evaluation.

Because of the strict 6-month maintenance recall program, periodontal stability (pocket depth less than 3 mm) was observed. The minimum periodontal support of the residual teeth was a 1:1 (crown:root) ratio. None of the abutment teeth at the initial follow-up evaluation had ill-fitting telescopic retained crowns, root decay, endodontic complications, fractures, or signs of periodontal disease. In addition, clinical signs of tooth intrusion leading to misfit of the prosthesis were not observed. However, nine natural teeth were later extracted over the duration of the follow-up period because of periodontal problems and/or deep decay. Seven of them were replaced with new implants; another two were lost and not replaced, but the prostheses were relined.

Fig 7 Partial denture before implant placement.

Fig 8 Partial denture after implant placement, relining, and polishing.

DISCUSSION

The present retrospective analysis of implants placed in the mandible and restored with telescopic abutments and then combined with periodontally healthy teeth for the support of existing removable prostheses demonstrates an interesting alternative solution for mandibular prosthetic rehabilitation. The combined use of teeth and implants in partially edentulous patients with removable prostheses is rarely discussed in the literature.[9–11] Dental implants in strategically favorable positions can provide better anchorage for a mandibular prosthesis. In this way, a failing partial denture can be saved with just one or two additional implants as supplemental abutments. This has benefits for the patient and is much less expensive than a new prosthetic rehabilitation.

Within the limitations of the study, which was not a prospective randomized clinical trial but a series of patients who underwent the same treatment, the authors demonstrated the viability of both surgical and prosthetic protocols using immediate functional loading. The biomechanical aspects of the telescopic (prefabricated) abutments were introduced in a 2-year follow-up study, and the long-term (10-year) data were evaluated earlier in another group of subjects.[5,7] In the present study, the combination of telescopic-retained abutments and residual teeth increased the retention of the partial dentures in the mandible. There was a 97% survival rate after a long-term evaluation period (minimum of 2 years of follow-up). Comfort scores for the patients were not available, since this was a retrospective study. In addition, the patients did not wear provisional prostheses, since the teeth were extracted and implants were placed and immediately loaded at the same visit.

The double-crown technique represents an ideal type of anchorage.[12–14] The possibility of pairing residual teeth with implants allows the transfer of the loading forces to the periodontal and peri-implant tissues in a manner that more closely resembles an implant-supported prosthesis rather than a tissue-retained prosthesis. The fact that periodontally compromised teeth in this patient group did not show intrusion is important compared to what has been observed in previous studies.[11,15]

In general, there are many studies supporting the hypothesis of the long-term clinical outcome of tooth-implant–supported fixed restorations.[1,16,17] Only one paper has been published regarding success rates of tooth-implant–supported partial dentures that used the same implant system with progressive thread design as used in the present study.[18] Considering the age of the patients included in this study, the present protocol may have advantages for patients with complex medical histories (especially older patients), who are not able to be treated with a large number of implants and who may require hospitalization or treatment by the specialist. The long-term data (mean loading period: 5 years) reported no complications in terms of insufficient stability of the prosthesis with the use of a prefabricated telescopic anchorage system. Other studies showed maintenance problems for patients with ball attachments or resilient telescopic crowns as

attachments for implant-supported overdentures.[19] In the present concept of mandibular rehabilitation, there is simplicity in the maintenance of the abutment teeth and implants for patients as well as dental hygienists. The results of the present study show that periodontally compromised teeth with attachment loss and reduced periodontal support, but without signs of periodontal disease, may be used with high success rates for removable anchorage, together with dental implants, without negatively influencing the clinical outcome, as has been previously reported.[20,21]

Further studies with a larger number of patients and multicenter evaluations are needed to confirm that this treatment concept could be the standard of care for patients with remaining natural dentition. In contrast to other prosthetic concepts presented in the literature, which used implants and ball attachments, magnets, or resilient telescopic crowns,[18,22–24] the present treatment protocol shows long-term success. Tissue-retained overdentures are associated with periimplant soft tissue complications (ie, gingival overgrowths) or loosening of the abutments.[25] This has been observed particularly with bar-retained restorations, which limit plaque control and have been associated with general maintenance problems.[26]

There is no doubt that this protocol can be used in a delayed loading protocol as well. Because no differences have been observed in the success or survival rates of implants loaded delayed or immediately in the mandible[27,28] and with this same implant design,[7,29,30] the immediate loading protocol as a treatment of choice is recommended. This will reduce the length of the treatment period and the number of patient visits. Strict patient selection criteria to minimize complications may be performed. However, removable prostheses in the mandible with early loading showed higher success rates (100%). The present protocol describes an immediate treatment solution that does not use provisional dentures, thereby improving patient comfort and reducing the cost of treatment.[31]

Because of the limitations of this retrospective study, which was performed in a private practice for oral and maxillofacial surgery, the authors did not have standardized periapical radiographs to determine possible crestal bone loss. However, magnification of panoramic radiographs taken under the same conditions in the clinical setting has been performed. Certainly, a future prospective clinical study focused on precise measurement of crestal bone levels would be of great importance. The soft tissue characteristics and plaque control around implants with platform switching (shifting), compared to that of residual teeth, is also of significant clinical interest. This topic is presently under investigation (data not shown).

CONCLUSION

Within the limitations of this retrospective clinical evaluation, the combination of immediately loaded implants and residual teeth with telescopic attachments to support restorations in the mandible seems to be a viable prosthetic option that may be used for the treatment of partially edentulous patients. It provides economic, technical, and clinical advantages.

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