TELESCOPIC CROWNS AS ATTACHMENTS FOR IMPLANT SUPPORTED RESTORATIONS: A CASE SERIES

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KEY WORDS

Dental implants
Telescopic crowns
Attachments
Dentures

The use of dental implants to support mandibular or maxillary overdentures is a widely used treatment modality. Advantages are an increase in retention, an increase in chewing ability, and easy access for oral hygiene procedures. While telescopic and conical crowns have been used for decades to connect natural teeth to overdentures, not many cases have been reported in the literature of telescopic crowns placed on implants to support overdentures. This article describes 7 patients with overdentures supported by telescopic crowns who received 65 implants (ITI Straumann). The cases presented in this report have been in function for up to 4.5 years. During that time no adverse events were reported. The use of telescopic crowns as attachments for implant-supported overdentures may be a viable treatment option.

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INTRODUCTION

The use of telescopic crowns on natural teeth (ie, a double crown system in which an interior crown with a cylindrical shape is placed on the tooth to support a removable crown), is a treatment concept that has been widely and successfully used to support dentures since telescopic crowns were introduced in the 1970s.[1–18] They allow for easy access for oral hygiene around the abutment teeth as well as easy handling of the overdenture.[4] The comparatively high retention obtained leads to good mastication and phonetics. Therefore, they often offer more advantages than other types of attachments.[4,6]

Telescopic crowns also allow for an overdenture design that includes teeth with questionable long-term prognosis, leaving room for later tooth removal if necessary, while still guaranteeing sufficient support of the denture.[4,6,11]

The use of implant-supported overdentures is a treatment approach with a very high long-term success rate.[19–22] The use of implants to support overdentures increases patient comfort by improving retention and chewing ability.

Compared to the use of fixed-implant–supported dentures, this treatment modality often leads to

an esthetically more pleasant result, the best access for oral hygiene, and allows for the use of a lower number of implants. Furthermore, the use of overdentures, tooth- or implant-supported, is often beneficial for phonetic reasons.[10]

Bar, ball, and magnetic attachments have been suggested to connect the overdenture to the implants.[23–25] Contrary to their use on natural teeth, there are not many reports in the literature on the use of telescopic crowns for the connection between implants and overdentures.

This article presents 7 cases of the use of telescopic crowns for the support of overdentures on dental implants (Table 1).

MATERIAL AND METHODS

Patient population

Sixty-one implants were inserted in 7 adult patients (4 female and 3 male; age range 38 to 62 years). All patients were free of any medical conditions interfering with implant treatment. Five (71.43%) patients were smokers and 2 (28.58%) were nonsmokers. All patients had been referred from general dentists and were not previously treated for periodontal disease at the time of the first examination.

Examination

Each patient underwent a comprehensive dental and periodontal examination. Periodontal charting included documentation of probing depths, recessions, clinical attachment levels, bleeding on probing, tooth mobility, furcation involvement, and plaque scores. Periodontitis was diagnosed in the presence of more than 4 sites with clinical attachment loss exceeding 4 mm, radiographic evidence of alveolar bone loss, and bleeding on probing. Impressions for diagnostic casts were taken and a panoramic radiograph was obtained. Casts were mounted on a semi-adjustable articulator after face-bow transfer and check-bite registration. An occlusal analysis was performed, diagnostic wax-ups were prepared on the articulated casts, and restorative treatment needs determined. Once the restorative and periodontal treatment plans were established, radiographic and surgical guides were fabricated to facilitate implant placement. Table 1 shows the patient treatment plan and time schedule.

Periodontal treatment

Periodontal treatment, including surgical treatment if necessary, had been performed previously on all patients.

Implant selection

Unless outlined differently, cylindrical screw implants with a large-grit sandblasted and acid-etched surface and either a 1.8-mm or a 2.8-mm smooth neck were used (ITI Straumann Standard Plus with a 1.8-mm smooth neck; ITI Straumann Standard with 2.8-mm smooth neck; Waldenburg, Switzerland; Table 2a and b). Implant size was determined based on assessment with a panoramic radiograph taken with a radiographic stent in place, and a clinical examination.

Medication

Standard medication for all cases included diclofenac (Voltaren; Novartis Pharma, Nürnberg, Germany), a nonsteroidal anti-inflammatory drug, 100 mg once a day for 4 days; clindamycin (Ratiopharm, Ulm/Donautal, Germany), a systemic antibiotic, 600 mg once a day for 6 days; and 0.1% chlorhexidine rinses (Chlorhexamed Fluid, GlaxoSmithKline, Bühl, Germany) twice a day. Medication was administered starting 1 day before surgery.

Surgical protocols

Unless outlined differently for any individual case, procedures were performed following the protocols outlined below.

Implant placement

An intersulcular incision extending to the first adjacent tooth on each side was placed and a full-thickness flap was elevated.

Implant sites were prepared at 875 rpm using a 16:1 hand piece (Nouvag AG, Goldbach, Switzerland) and a microcomputer-controlled surgical micro motor (micro-dispenser model 7/8000, Nouvag).

Implants were inserted and tightened to a torque of 35 N with a hand ratchet (model 046.119/046.049; Straumann).

The surgical site was covered with a resorbable bilayer membrane (BioGide, Geistlich Biomaterials, Wolhusen, Switzerland).

Socket preservation

If tooth extraction was necessary in the area of implant placement, the indicated tooth was removed with as little surgical trauma as possible. Following curettage, the extraction socket was irrigated, and covered with a 25 × 30 mm, nonresorbable membrane (Cytoplast Regentex GBR-200, Oraltronics, Bremen, Germany). Membranes were removed after 4 weeks.

Sinus augmentation

If necessary, sinus augmentation was performed following a previously described protocol.[26] A

TABLE 1
Patient treatment and time schedule

Patient No.	Age (Year)	Sex	Smoke	Extraction (Day)	Implant Placement (Day)	Sinus Lift (Day)	Loading (Day)	Restoration in the Maxilla	Restoration in the Mandible*	Evaluation (Day)
1	50	Male	Yes	5/17/2002	10/31/2002		2/10/2003	Complete denture	Telescopic crown supported overdenture	1/31/2006
2	53	Female	No	1/23/2003	10/10/2003	4/29/2003	4/9/2004	Telescopic crown retained free palate partial denture	Natural teeth, crowns, and FPDs	1/31/2006
3	53	Female	Yes	12/12/2001	4/5/2002	4/5/2002	10/1/2002	Telescopic crown supported free palate overdenture	Telescopic crown supported overdenture	1/31/2006
4	62	Male	No	9/12/2000	3/9/2001		7/19/2001	Telescopic crown supported covered palate overdenture	Telescopic crown supported overdenture	1/31/2006
5	52	Female	Yes	5/31/1999	1/25/2002		6/10/2002	Telescopic crown supported free palate overdenture	Natural teeth and implant supported FPDs	1/31/2006
6	50	Male	Yes	7/10/2001 (maxilla) 6/25/2002 (mandible)	3/27/2003 (maxilla) 1/5/2002 (mandible)	11/19/2002	12/5/2003	Telescopic crown supported free palate overdenture	Telescopic crown supported overdenture	1/31/2006
7	38	Female	Yes	1/21/2002	9/13/2002	3/28/2002	12/11/2002	Telescopic crown retained free palate partial denture	Natural teeth and implant supported FPDs	1/31/2006

*FDP indicates fixed partial denture.

1:1 mixture of bovine allograft (0.25-1 mm, 0.25 g; BioOss spongiosa, Geistlich Biomaterials) and autogenous corticocancellous bone (harvested from the retromolar or chin area) was used as the graft material. The access window was covered with a resorbable barrier membrane (BioGide, Geistlich Biomaterials). The membrane was fixated with absorbable pins (Resor Pins, Geistlich Biomaterials).

Patients were instructed to avoid wearing any removable dentures for the first 2 weeks postoperatively. Postoperative follow-up visits were scheduled at 1, 4, and 7 weeks.

Implant placement was performed 4 to 6 months after the sinus augmentation surgery or simultaneously with the augmentation if the residual alveolar crest height exceeded 4 mm.

Maintenance

Supportive periodontal therapy was performed every 4 months. At each appointment, pocket depth (PD), clinical attachment level (AL), bleeding on probing (BOP), and plaque accumulation (PI) were recorded at 4 sites of each implant.

AL was defined as the distance in mm between the deepest point of the peri-implant area and the smooth neck section of the implant. Measurements were obtained by the use of a periodontal probe (KM0805, Hu-Friedy, Leimen, Germany).

Removal of soft and hard deposits around the implants and natural teeth, as well as irrigation of the peri-implant area with 0.1% chlorhexidine (GlaxoSmithKline), was performed at each visit; oral hygiene instructions were also given.

TABLE 2A

Diameter (in mm), length (in mm), and type,* of implants used in the maxilla

Patient No. 1 (0 Implants)	Patient No. 2 (8 Implants)	Patient No. 3 (6 Implants)	Patient No. 4 (2 Implants)	Patient No. 5 (6 Implants)	Patient No. 6 (8 Implants)	Patient No. 7 (7 Implants)
	#6 (04.1 mm, 10 mm, RN)	#4 (4.1 mm, 12 mm, RN, PLUS)	#6 (4.1 mm, 12 mm, RN, PLUS)	#5 (4.1 mm, 10 mm, RN, PLUS)	#8 (4.1 mm, 10 mm, RN)	#8 (4.1 mm, 10 mm, RN)
	#5 (4.1 mm, 10 mm, RN)	#6 (3.3 mm, 12 mm, RN, PLUS)	#11 (4.1 mm, 12 mm, RN, PLUS)	#6 (4.1 mm, 12 mm, RN)	#6 (4.1 mm, 10 mm, RN)	#6 (4.1 mm, 12 mm, RN)
	#4 (4.1 mm, 10 mm, RN)	#7 (4.1 mm, 12 mm, RN, PLUS)		#8 (4.1 mm, 12 mm, RN)	#4 (4.8 mm, 10 mm, RN)	#16 (4.8 mm, 10 mm, WN)
	#3 (4.1 mm, 10 mm, RN)	#10 (4.1 mm, 12 mm, RN, PLUS)		#9 (4.1 mm, 12 mm, RN)	#3 (4.8 mm, 10 mm, RN)	#9 (4.1 mm, 10 mm, RN)
	#11 (4.1 mm, 10 mm, RN)	#11 (3.3 mm, 12 mm, RN, PLUS)		#11 (4.1 mm, 12 mm, RN)	#9 (4.1 mm, 10 mm, RN)	#11 (4.1 mm, 12 mm, RN)
	#12 (4.1 mm, 10 mm, RN)	#13 (4.1 mm, 12 mm, RN, PLUS)		#12 (4.1 mm, 10 mm, RN)	#11 (4.1 mm, 10 mm, RN)	#12 (4.1 mm, 10 mm, RN)
	#13 (4.1 mm, 10 mm, RN)				#13 (4.1 mm, 10 mm, RN)	#14 (4.8 mm, 8 mm, PLUS, WN)
	#14 (4.1 mm, 10 mm, RN)				#14 (4.8 mm, 10 mm, RN)	

*Types of Straumann ITI implants: RN indicates Regular Neck; WN, Wide Neck; NN, Narrow Neck. Standard implants were used, unless otherwise specified (PLUS).

Cases

Case I

A 50-year-old man presented in the office for a complete oral rehabilitation. Clinical and radiographic evaluation revealed that none of the remaining teeth were salvageable for either periodontal or restorative reasons. Therefore, the treatment plan included the extraction of all remaining teeth; fabrication of a complete maxillary denture; and an implant retained, supported complete denture for the mandible, using telescopic crowns as attachments.

After the extraction of all remaining teeth, provisional complete dentures were delivered. Five months later, 6 ITI implants were placed in the mandible. Four months later a complete maxillary denture was delivered. An implant-supported complete mandibular denture using telescopic crowns as attachments was fabricated at the same time.

Case II

The 53-year-old woman was referred for periodontal and implant treatment by her general dentist. In the maxilla, only tooth No. 6 was remaining. This tooth was nonsalvageable.

Tooth No. 6 was extracted, and scaling and root planing was performed in the mandibular dentition. The periodontal condi-

TABLE 2B

Diameter (in mm), length (in mm), and type,* of implants used in the mandible

Patient No. 1 (6 implants)	Patient No. 2 (0 Implants)	Patient No. 3 (6 Implants)	Patient No. 4 (6 Implants)	Patient No. 5 (4 Implants)	Patient No. 6 (6 Implants)	Patient No. 7 (0 Implants)
#23 (4.1 mm, 10 mm, RN)		#19 (4.8 mm, 12 mm, WN, PLUS)	#19 (4.1 mm, 12 mm, RN, PLUS)	#19 (4.1 mm, 12 mm, RN)	#29 (3.3 mm, 8 mm, RN, PLUS)	
#22 (4.1 mm, 10 mm, RN)		#20 (4.1 mm, 12 mm, RN, PLUS)	#21 (4.1 mm, 12 mm, RN, PLUS)	#23 (3.3 mm, 12 mm, NN)	#28 (4.1 mm, 12 mm, RN, PLUS)	
#20 (3.3 mm, 10 mm, RN)		#22 (3.3 mm, 12 mm, RN, PLUS)	#24 (4.1 mm, 12 mm, RN, PLUS)	#30 (4.1 mm, 12 mm, RN, PLUS)	#26 (3.3 mm, 12 mm, RN)	
#26 (4.1 mm, 10 mm, RN)		#27 (3.3 mm, 12 mm, RN, PLUS)	#25 (4.1 mm, 12 mm, RN, PLUS)	#26 (3.3 mm, 12 mm, NN)	#24 (3.3 mm, 12 mm, RN)	
#27 (4.1 mm, 10 mm, RN)		#29 (4.1 mm, 12 mm, RN, PLUS)	#27 (4.1 mm, 12 mm, RN, PLUS)		#22 (4.1 mm, 12 mm, RN, PLUS)	
#29 (3.3 mm, 10 mm, RN)		#30 (4.8 mm, 12 mm, WN, PLUS)	#30 (4.1 mm, 12 mm, RN, PLUS)		#21 (4.1 mm, 12 mm, RN, PLUS)	

*Types of Straumann ITI implants: RN indicates Regular Neck; WN, Wide Neck; NN, Narrow Neck. Standard implants were used, unless otherwise specified (PLUS).

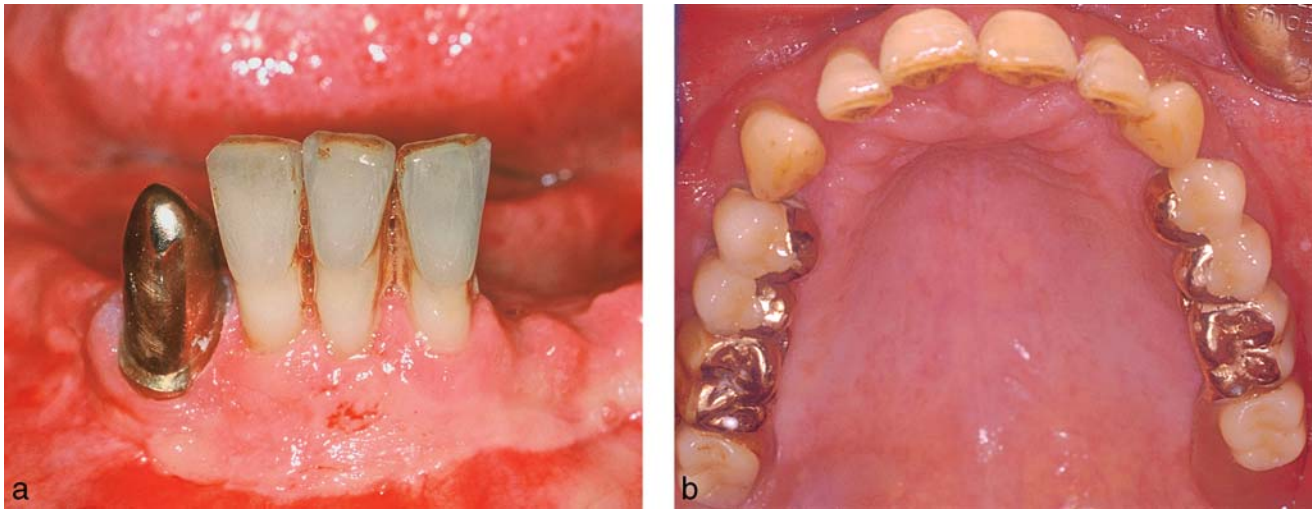


FIGURE 1. Patient No. 6, before treatment. (a) Mandibular dentition. (b) Occlusal view of the maxilla.

tion appeared stable after the initial treatment phase. No further periodontal treatment other than regular supportive therapy was necessary.

Four months after tooth extraction, a bilateral sinus augmentation procedure was performed. After a healing period of 8 months, 8 ITI implants were placed in the maxilla. Six months after insertion, the implants were loaded with a telescopic crown retained removable denture. The denture was designed with a free palate (horseshoe-shape).

Case III

A 53-year-old woman presented in the office for a full mouth reconstruction. Clinical and radiographic examination revealed that none of the remaining teeth were salvageable.

It was decided to extract all the remaining teeth and to place implant retained overdentures.

Four months after extraction, sinus augmentation was performed bilaterally and 6 ITI implants each were placed in the maxilla and the mandible.

After a healing period of 6 months, implant retained overdentures, using telescopic crowns as attachments, were delivered. The maxillary overdenture was designed with a free palate (horseshoe-shape).

Case IV

A 62-year-old man presented for an implant-supported full mouth reconstruction. All remaining teeth had to be extracted and provisional full dentures were delivered.

Six months later, 2 ITI implants were placed in the maxilla, and 6 ITI implants were placed in the mandible.

Five months later, a telescopic crown–supported, palate-free complete maxillary denture and a telescopic crown-supported mandibular overdenture were delivered.

Case V

A 52-year-old woman presented for periodontal treatment und a subsequent full mouth reconstruction.

Generalized radiographic horizontal bone loss was present in the mandible reaching 50% of the root length. The bone loss around teeth No. 18, 23, 26, and 31 ex-

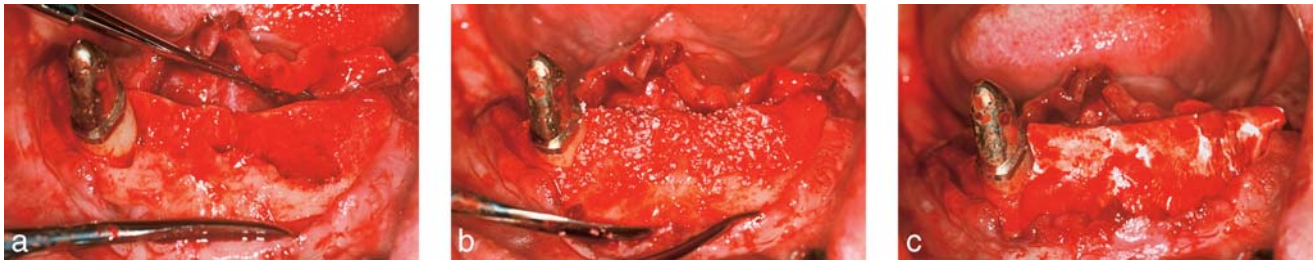
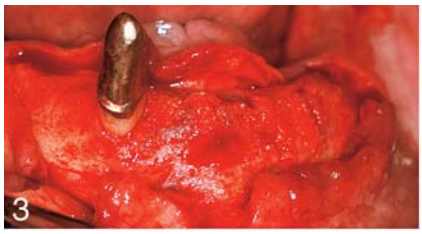
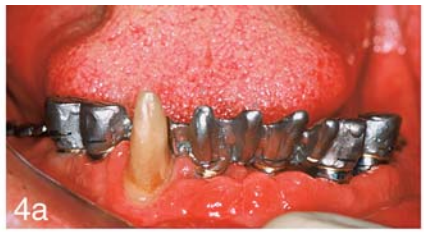
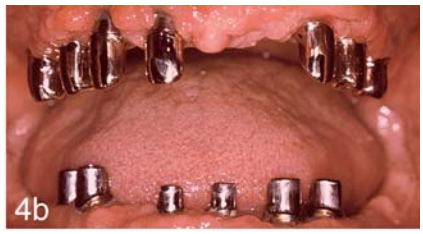
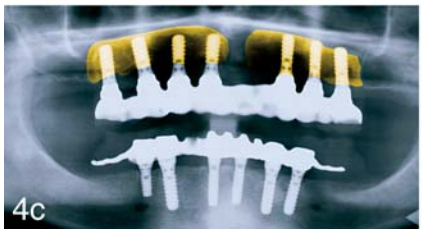


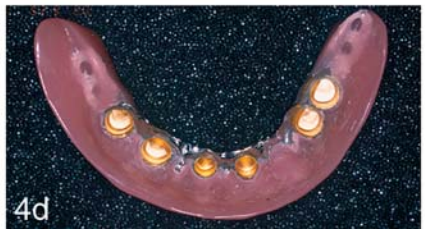
FIGURE 2. Patient No. 6. (a) Mandible after extraction. (b) Socket augmented with bovine bone spongiosa. (c) Area covered with a resorbable membrane.











FIGURES 3 AND 4. FIGURE 3. Patient No. 6, mandible at re-entry. FIGURE 4. Patient No. 6, final restoration. (a) Telescopic crowns and superstructure try-on. (b) Telescopic crowns in place in the maxilla; prosthetic abutments placed in the mandible. (c) Panoramic radiograph with the metal frame in place; augmented areas outlined in yellow. (d) The final mandibular over-denture. (e) Overdentures in place.

tended to the apices. Generalized horizontal bone loss was present in the maxilla reaching 65% of the root length.

Probing depths ranged between 6 and 9 mm. Teeth No. 18 and 31 had clinical furcation involvement Class III.

All maxillary teeth presented with Class III mobility, spontaneous bleeding, and gingival sensitivity upon touch.

The patient was diagnosed with chronic periodontitis.

All maxillary teeth and teeth No. 18, 23, 26, and 31 were extracted. The areas of teeth No. 20, 21, 22, 27, 28, and 29 were treated with access periodontal surgery. A provisional maxillary denture was delivered. Fixed partial dentures were placed on teeth No. 20, 21, 22, 27, 28, and 29.

A temporary complete denture was designed for the maxilla. Six months after extractions and periodontal surgery, 4 ITI implants were placed in the mandible, and 6 ITI implants were placed in the maxilla. The number of implants was limited to 6 since the patient preferred not to undergo sinus augmentations.

Six months after implant placement, an implant-supported horse shoe-shaped complete maxillary denture with telescopic crowns as abutments was delivered. Cemented crowns were placed on the mandibular implants.

Case VI

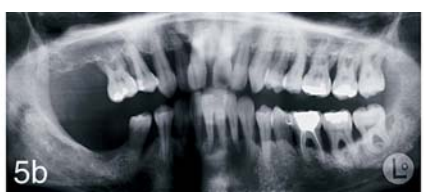
A 50-year-old man presented to the practice reporting spontaneous bleeding and mobility on all teeth.

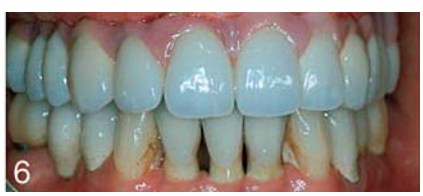
Initial periodontal treatment consisting of scaling and root planing and oral hygiene instruction had been performed 5 years earlier (March 1996). The patient did not finish this treatment phase and refused the suggested surgical treatment and supportive periodontal therapy. He opted to return to his general dentist for further treatment.

Clinical examination showed severely increased probing pocket depth, bleeding and suppuration on probing, and mobility on all teeth (Figure 1a and b). Radiographic analysis revealed bone loss of more than 70% on all teeth.

The condition was diagnosed as a generalized severe periodontitis (AAP Type IV).

All teeth of the remaining dentition had a poor long-term prog-





FIGURES 5 AND 6. FIGURE 5. Patient No. 7, initial examination. (a) Frontal view. (b) Panoramic radiograph. FIGURE 6. Patient No. 7, after implant placement; final restorations and denture in place.

nosis; therefore, it was decided to extract all teeth.

The extractions were performed during the first treatment phase except for tooth No. 27. A cyst in that area was removed. Tooth No. 27 was kept to increase the retention of the provisional denture and scheduled for extraction later. Bony defects were augmented with demineralized bovine bone (BioOss spongiosa, 0.25-1 mm, 0.25 g; Geistlich Biomaterials) and covered with a 25 × 25 mm resorbable bilayer membrane (Bio-Gide, Geistlich Biomaterials) (Figure 2a through c).

An intermediate denture supported by tooth No. 27 was delivered. After 3 months, the area was reopened (Figure 3) and 6 ITI implants were inserted. At the same time, tooth No. 27 was extracted and the socket was preserved.

Three months after insertion, the implants were uncovered and the telescopic crowns and the final denture delivered.

To allow for the insertion of implants in the maxilla, a bilateral sinus-augmentation was performed. Seven months after augmentation, 8 ITI implants were inserted.

Implant No. 8 was mobile 5 weeks after placement and had to be removed. The site was rinsed with sterile saline solution and covered with a 20 × 30 mm nonresorbable membrane (Cytoplast Regentex GBR-200, Oraltronics). The membrane was removed after 1 month.

A telescopic crown supported free palate (horseshoe-shaped) final overdenture was delivered at the 9-month point (Figure 4a through e).

Case VII

A 38-year-old woman presented in the office for a regular dental examination. Clinical evaluation revealed severely increased probing pocket depth. Radiographic signs of horizontal and vertical bone loss up to two-thirds of the root length were present (Figure 5a and b). The maxillary molars had Class III furcation involvement. All teeth in the maxilla had a poor prognosis.

The patient was informed of the etiology of her periodontal problems.

The maxillary teeth were extracted 2 weeks after the initial examination and an intermediate denture in the maxilla was delivered during the same appointment.

Oral hygiene instructions were given and prophylactic cleanings were performed repeatedly for the remaining teeth until an adequate level of plaque control could be achieved.

Bilateral sinus augmentation was performed 2 months after the extraction of the maxillary teeth.

At the 6-month point (ie, 4 months after the sinus augmentation), 7 ITI implants were inserted into the maxilla.

The maxillary implants were uncovered after a 3-month healing period (ie, at the 9-month point) and an implant-retained, free palate complete denture with telescopic crowns as abutments was delivered (Figure 6).

Discussion

Telescopic crowns have been used successfully for several decades to connect dentures to natural teeth.[1–18]

Advantages of their use are easier accessibility to oral hygiene procedures and the relative independence of the individual attachments, which often allows for sufficient support of the denture even after single abutments have failed.[4–6,11,24] They also offer a very high degree of retention and a comparatively rigid connection to the abutments.[25]

A possible disadvantage of the use of these attachments is the technically challenging and time-consuming process of fabricating them, resulting in comparatively high costs for this type of treatment.[25,27] Another disadvantage can be the bulkiness of the crowns often associated with their use, possibly leading to an unsatisfactory esthetic treatment outcome. This is usually only a problem if teeth with a vital pulp are used as abutment teeth, thus limiting the amount of tooth substance that can be removed to allow sufficient space for the crown and the coping. In cases where implants are used, the primary telescope usually can be designed sufficiently small so as not to result in an overly bulky superstructure.

A possible loss of retention resulting from mechanical wear of the copings has been discussed;[27] despite the advantages, there are not many cases using these attachments on implants reported in the literature.

The use of cemented, rigid-telescopic crowns has been suggested to avoid disadvantages of screw-retained superstructures, such as difficult access to the screw, access holes on the occlusal surface or in functional or esthetically unfavorable positions. At the same time, they still allow easy removal of the superstructure if necessary, thus combining the advantages of cemented crowns with those of screw-retained ones. This approach may also be helpful in cases where improper implant position needs to be compensated.[28–31]

Another option is the use of telescopic crowns with implant-supported overdentures. Although only limited data are

available on this type of treatment, the results so far indicate that this treatment modality can lead to predictable long-term treatment outcomes.[25,32,33] In addition to the above-mentioned advantages of telescopic crowns, they also allow for more freedom in the placement of the implants compared to bar attachments since there is no risk of reducing the tongue-space.[34] This can be an advantage in cases where ideal implant position or inclination cannot be achieved.

One has to differentiate between the use of rigid and nonrigid telescopic crowns. Rigid telescopic crowns have a definite end position (ie, a rest on the abutment where the coping rests). Friction is low enough to allow for easy removal of the overdenture but sufficiently high to minimize movement during function. Nonrigid telescopic crowns, also known as resilient crowns, have no defined apical end positions. They do allow for a certain amount of vertical movement under load, thus distributing forces to the mucosal rest areas.[4]

While rigid telescopic crowns allow for a higher stability of the overdenture, the use of two implants in the interforaminal area may not be advisable, since the denture may act as a lever placing unnecessary high stress on the implants, possibly leading to their fracture.[25] More clinical data are necessary to verify these findings.

Two implant, nonrigid telescopic dentures, on the other hand, show a long-term treatment outcome comparable to other type of implant-supported attachments.[32]

The existing data suggest that implant-supported telescopic crowns can be a viable alternative to the commonly used bar and ball attachments.

No conclusive data on the combined use of implants and natural teeth to support fixed or removable dentures exist so far. Both the successful use of this approach as well as the failures have been reported with the possible intrusion of the tooth being one of the major problems, irrespective of the use of a rigid or flexible connection between the tooth and the implant.[10,35–48] The use of telescopic crowns may be a treatment modality that allows for the successful combined use of natural teeth and implants to support dentures. At this point a conclusion on the validity of this treatment approach cannot be made, thus leaving the final decision on the judgment of the clinician.

The case treatments presented in this report have been in function for up to 4.5 years after loading. During that time no adverse events were reported.

None of the patients have had difficulties inserting or removing the overdentures, nor has the retention decreased significantly.

The regular recall visits revealed no signs of inflammation of the tissues around the implants, indicating that the patients had no problems in cleaning the implants.

CONCLUSIONS

This case series demonstrates that dental implants with telescopic crowns may be used successfully for the support of removable dentures.

Further studies with a larger number of cases are necessary to validate these findings and to allow for final conclusions on the long-term predictability of this treatment approach.

NOTE

Straumann did not provide any financial support for this study.

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