Telescopic Prostheses for Implants

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This retrospective study investigated the outcome of 73 telescopic implant-supported fixed prostheses. Fifty-four prostheses were entirely cement-retained, and 19 incorporated a screw-clamping unit. The rate of complications was low and in most cases minor in nature. Cement-retained prostheses involving a distal cantilevered extension required the greatest postoperative maintenance. Despite the small number of combined screw- and cement-retained prostheses, the lack of complications and ease of retrievability make this approach worthy of further study.
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Key words: cantilever extensions, cement-retained prosthesis, implant, telescopic prosthesis

The quest continues for more esthetic implant-supported fixed prostheses. Initial efforts were concentrated on eliminating the metal display of the titanium transmucosal element. These efforts led to the acceptance of crown margins at or just below the level of the mucosa and to the development of a new series of segmented and nonsegmented abutments.[1–3] The esthetic problem often involved more than merely the color of the transmucosal section; in many situations, the contours of the transmucosal section bore little relationship to those of the original tissues or those adjacent to the restoration. The solution required the production of an implant abutment with the correct emergence profile to allow for modifications to adapt it to implant alignment, preferably without the need for prosthetic screw access holes.[4,5] This led to a reexamination of telescopic prostheses.

Because of their versatility, telescopic restorations are firmly established in prosthodontic protocols. Minor misalignments of the abutment could be overcome by the contours of inner copings, while the outer structure could be luted over them on a definitive basis or made removable by the clinician or even by the patient. As an additional feature, small screw retainers were occasionally employed to unite the inner and outer sections of the restoration. Such advantages often outweighed the drawbacks of bulk, complexity, and cost.[6]

The telescopic approach is now gaining favor in implant prosthodontics, where pulpal considerations do not apply yet misaligned implants are not unknown and occasionally are inevitable. Implant abutments used as inner copings permit modifications of their contours, to provide a common path of insertion for the overlying prosthesis. Even with well-aligned implants, such an approach allows correct emergence profiles to be established for individual abutments, so as to provide a lifelike appearance.[7–9] Furthermore, telescopic prostheses obviate the need for screw holes penetrating the outer structure, as the abutment screw holes only involve the inner copings. Laboratory-produced cast abutments can be made for individual implants, but it is difficult to achieve the accuracy and fine finish of a specially produced machine unit.[1,10,11]

Allowing for removal of the outer section is another factor. Seating the outer structure with a temporary cement is the simplest approach, but it raises the possibility of accidental dislodgement or, worse still, inability to remove the restoration when required. Many temporary cements, particularly those that are zinc oxide–eugenol based, have a somewhat greater film thickness than those used for definitive luting. Particular care is necessary with the seating if marginal discrepancies are to be avoided.

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Experience with telescopic implant prostheses demonstrated their usefulness and capacity to provide esthetic results. In a small sample of prostheses, a screw-retained unit was incorporated among a group of telescopic abutments. In a previous paper,[9] the outcome of the abutments was examined. This work investigates the history of the prostheses.

Materials and Methods

In this retrospective study, 41 partially or completely edentulous patients, 24 women and 17 men between 19 and 83 years (mean 58.85 years), were provided with restorations supported by 230 Brånemark implants (Nobel Biocare, Göteborg, Sweden). Of the 41 patients, 8 men and 5 women were smokers.

The treatment plans and restorative aspects of the therapy were undertaken by an experienced prosthodontist. Clinical assessments and implant surgery procedures have been previously reported.[9] Two hundred thirty-eight implants were placed, 126 in the maxilla and 112 in the mandible. At uncovering, an appropriate healing abutment was selected for each implant. One group of surgeons used Nobel Biocare healing abutments, and the other used DIA healing abutments (Steri-Oss, Yorba Linda, CA). Two hundred thirty implants were uncovered, for which 115 Nobel Biocare and 115 DIA healing abutments were used. Four implants failed during the osseointegration period, while 4 implants were not restored and “put to sleep.” A total of 73 telescopic prostheses were fabricated for 41 patients.

Prosthodontic Procedures. Transitional prostheses were fabricated when necessary. Thirty-seven transitional prostheses were made; 12 were resin fixed partial dentures (FPD) supported by natural abutments, 9 were overdentures, 8 were partial dentures, 5 were telescopic fixed prostheses, 2 were complete dentures, and 1 was a resin-bonded prosthesis.

“Single” tooth impression copings were placed over each implant and the impression was made in Impregum F (Fabrik Pharmazeutischer Praparate GmbH, Seefeld, Germany). Implant analogues were placed on each impression coping, and the impression was cast to incorporate soft material (Gingifast Zhermack, Pollesine, Italy) around the implant sites. The implant alignments were analyzed on the master cast.

The DIA titanium abutments were prepared on the master cast, and modifications were made to their axial walls, height, and shoulders, as necessary. A vertical line was inscribed on the facial surface of each abutment to assist in its correct location on the implant in the mouth. Detailed descriptions of their characteristics and selection procedures have been previously reported.[7] Estheticone abutments (Nobel Biocare), when used, were placed on the master cast in their selected sites, and the matching gold cylinders were positioned.

The waxup of the prosthesis permitted a final check for contours of the restoration and screw access holes for the Estheticone units. The framework was cast in a platinized gold alloy suitable for a high-fusing porcelain gold alloy. For patients whose implants were placed in type 3 or type 4 bone, a second waxup was made for an acrylic resin transitional prosthesis. The technique proved so useful in finalizing details of appearance and articulation that it was later employed in all large-span prostheses, irrespective of bone quality.

Placement of the prosthesis was undertaken in several steps. Following cleaning and autoclaving of the components, the prepared abutments were seated on their respective implants. The abutment screws were lightly tightened, and intraoral radiographs were taken to ensure correct seating. Then the abutment screws were tightened. A hand torque wrench (0.047-inch Torque wrench Hex Insert, Steri-Oss) was used for the DIA abutments; an electronically controlled motor-driven torque wrench (20 N/cm) was used for the Estheticone abutments. Adaptation of the metal framework was checked with a Fit Checker (GC America, Chicago, IL). Occlusal adjustments were made, proximal spaces were checked, and the prosthesis was placed using Temp Bond and Modifier (Kerr USA, Romulus, MI) as a temporary cement. The prosthesis was seated by hand, and the small gold screws in the Estheticone abutments were seated and tightened. Prostheses that were entirely cement-retained were also hand seated, but no modifier was placed. Excess cement was removed, and the patient was seen after 1 day and then 1 week later. A subsequent examination was made after further periods of 2 weeks, 1 month, 3 months, and then at 6-month intervals. The prosthesis was removed on each of the first three visits to assess pontic-mucosa relationships, abutment screw tension, and the health of the surrounding tissues. It was not removed subsequently unless there was a clinical indication. Postoperative radiographs were taken at this stage and annually thereafter unless a complication arose. Hygienist maintenance visits were made 1 week later, at 3 months, and then at 6-month intervals.

Results

Seventy-three telescopic prostheses were fabricated for 41 patients. Thirty-two of the prostheses were mandibular, and 41 were maxillary. Five of the prostheses in the maxillae and 9 in the mandibles were

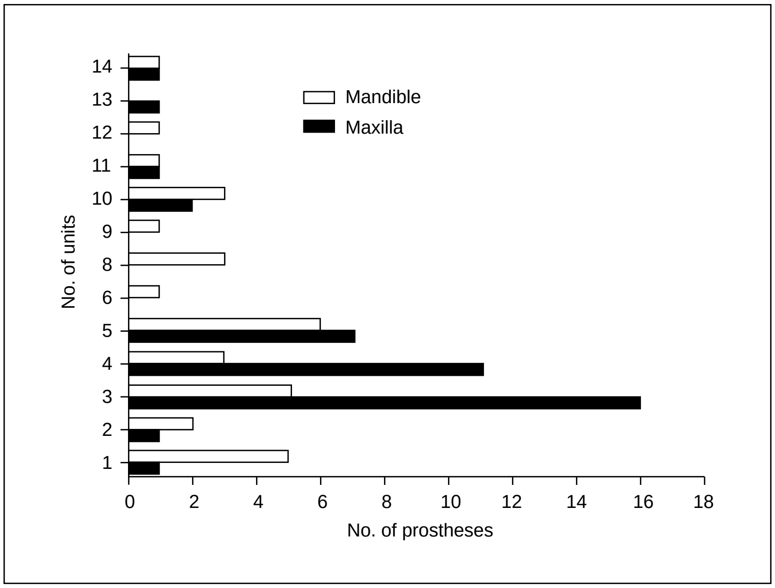


Fig 1 The number and distribution of telescopic prostheses used.

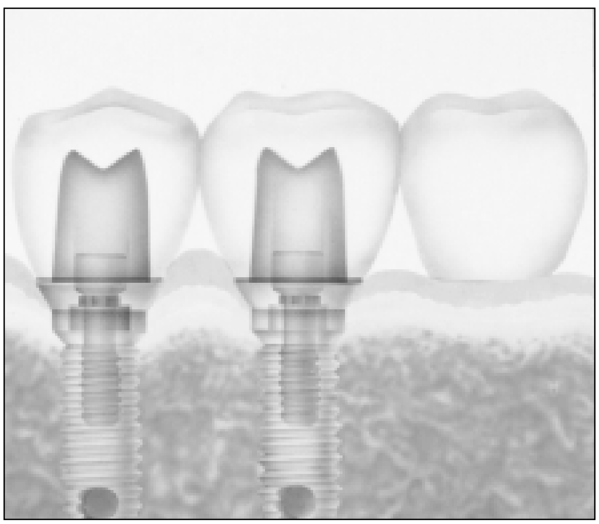


Fig 2 Diagrammatic representation of a cement-retained telescopic prosthesis.

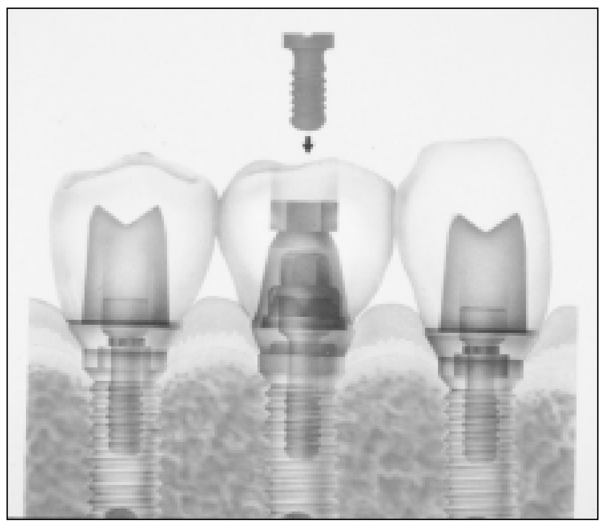


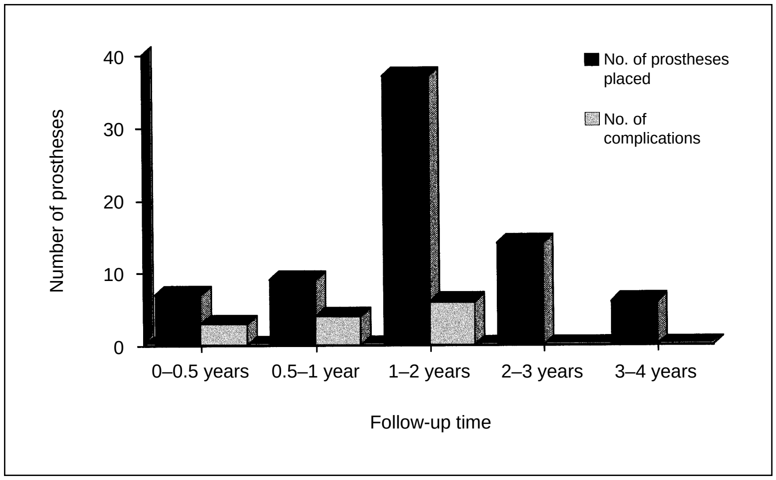
Fig 3 Diagrammatic representation of a screw-retained telescopic prosthesis.

complete arch restorations. The number and distribution of these restorations are shown in Fig 1.

Restoration Categories According to Abutment Type. Of the 73 total telescopic prostheses, 54 were designed exclusively with DIA abutments (cement-retained telescopic prostheses) (Fig 2). The other 19 prostheses were designed using a combination of DIA and Estheticone abutments (screw-retained telescopic prostheses) (Fig 3). To the 54 cement-retained telescopic (CRT) prostheses, 151 DIA abutments were connected. During an average postloading period of 547 days (minimum 43, maximum 1,082), 19 of the DIA abutments presented the first time with loose screws.

The first screw-retained telescopic (SRT) prosthesis was placed on June 23, 1993; before that date, all prostheses fabricated were cement-retained. The 19 SRT prostheses were supported by 54 DIA and 34 Estheticone abutments. Two DIA and 1 Estheticone abutments later presented with loose screws. While

Fig 4 Postplacement complications.



every effort was made to keep tooth and implant-supported components separate, this was not always feasible. Nine prostheses (12.33%) included inner copings attached to roots. No tooth intrusion was noted in the period of the study.

Complications of Telescopic Prostheses. The follow-up time for all 73 prostheses is shown in Fig 4. A peak in complication frequency occurred between the first and second year of loading. Thereafter, the complication frequency decreased rapidly to almost zero.

Retention problems occurred in 4 of the 54 CRT prostheses. On two occasions, CRT prostheses could not be removed when desired. Both prostheses required the cutting of holes through the occlusal surfaces of the crowns to permit access to the abutment screws. Both restorations employed DIA abutments with unreduced height and unmodified axial walls. One restoration was an implant telescopic fixed prosthesis with a distal cantilever and the second a tooth and implant telescopic fixed prosthesis with a distal cantilever. Another two CRT restorations suffered accidental dislodgement. One CRT prosthesis loosened while the patient was abroad. It was reseated by a colleague, who left an excess of cement submucosally and failed to seat the prosthesis.

Modifications of the prostheses included:

1. Shortening of the prosthesis in three CRT restorations (Fig 5) as a result of implant failure. Furthermore, removal of the distal cantilever was required in one implant-supported telescopic prosthesis that also incorporated a mesial and a distal cantilever to overcome a continuously loose abutment.
2. Changing of the design of two CRT prostheses (Fig 6).

Only on three occasions did a misfit of the framework occur, requiring new castings and modification of an additional prosthesis to provide smaller teeth. All were tooth- and implant-supported CRT prostheses with distal cantilevers.

None of the 19 SRT prostheses presented any complication during the follow-up time. Distribution of the SRT prostheses according to their type is shown in Fig 7.

Discussion

The telescopic treatment option provides the clinician with versatility in the design of the fixed implant-supported prosthesis and allows the development of optimal emergence profiles together with excellent esthetics. It avoids the need for multiple prosthetic screw access holes that can detract from appearance and weaken the superstructure, should a hole pass through a cusp tip or close to the facial or lingual surface. Papavasiliou et al[12] showed that cemented restorations distributed less stress to weak areas of the abutments than screw-retained restorations. The esthetic and functional advantages of a telescopic system appear to be reinforced by a relatively incident-free postplacement period.[6,9] Those that did occur were of a relatively minor nature. The introduction of the manually operated torque wrench virtually eliminated the occurrence of loosened DIA abutment screws.[9]

It is considered wise practice to separate implant- and tooth-supported components.[13] This separation

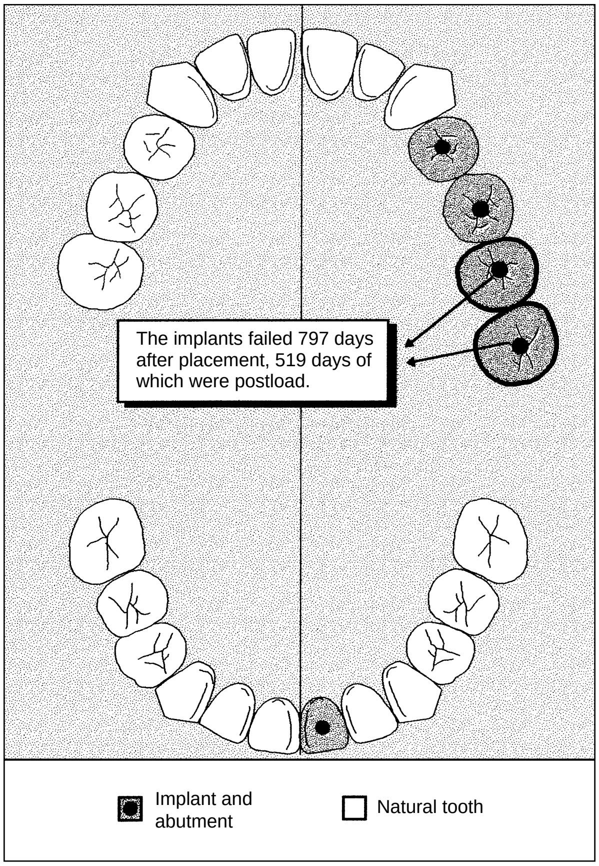


Fig 5 An example of implant failure and consequential shortening of the prosthesis.

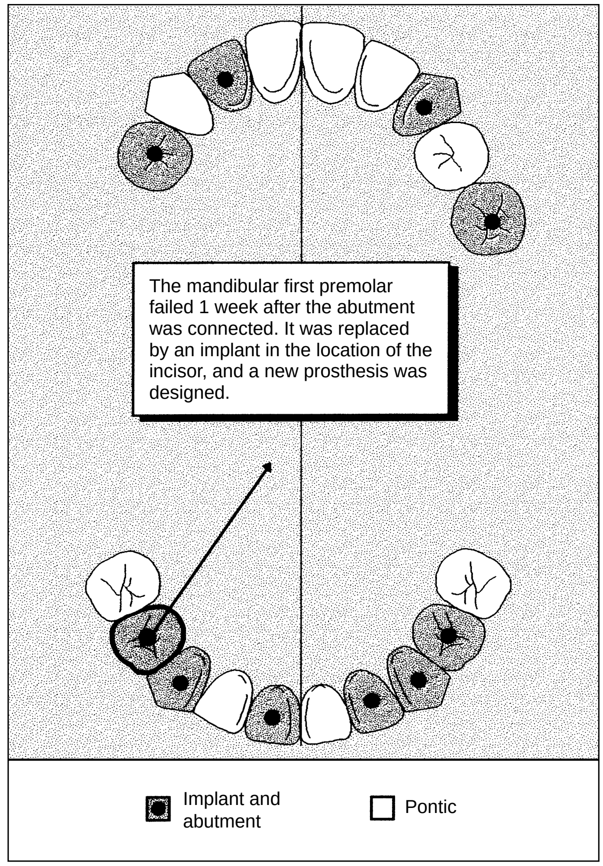


Fig 6 An example of implant failure and subsequent treatment.

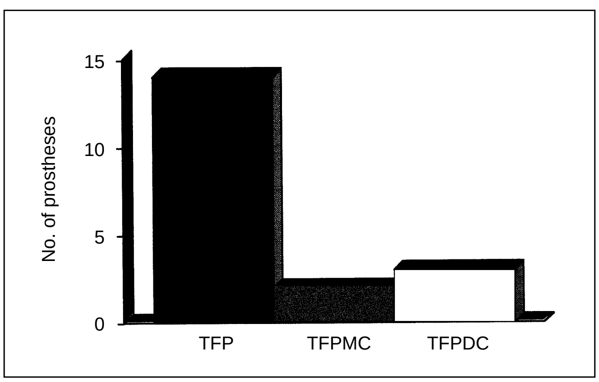


Fig 7 Distribution of the designs of the screw-retained telescopic prostheses: TFP = telescopic fixed prosthesis; TFPMC = telescopic fixed prosthesis with mesial cantilever; TFPDC = telescopic fixed prosthesis with distal cantilever.

was not always feasible in this study population, and nine prostheses included inner copings attached to roots. No tooth intrusion was noted during the period of study.

Accidental dislodgement of cement-retained telescopic prostheses was experienced with two restorations incorporating distal cantilevered portions. This loosening was detected by the patient before the restoration was lost and did not require an emergency visit. This complication rate (3.7%) is low compared with that reported by Singer and Serfaty,[14] who experienced cement washout rates of 9.8%. Accidental dislodgement of cement-retained telescopic prostheses can be prevented by using minimally tapered abutments and careful selection of the luting agent. Crowns luted with zinc oxide–eugenol cement may provide the least resistance to cyclic lateral stresses,[15] whereas crowns luted with resin composite cement may be more resistant to dynamic loading than those placed using glass-ionomer or zinc-phosphate cements. Temporary luted restorations that loosen are a nuisance to patient and clinician alike; temporarily luted restorations that cannot be removed when required can be a major problem, particularly when the prosthesis has been incorrectly seated.

Introducing a screw-retained abutment into a series of cement-retained telescopes has been remarkably incident-free. The screw retainer permits the use of a weak temporary cement on the telescopic abutments, facilitating removal when required, yet ensuring that accidental dislodgement will not occur. If the screw-retained unit is centrally placed, it facilitates seating and may result in less internal stress within the casting than a unit with a series of screw retainers. However, the small sample size in this series did not justify more than passing comment, and further study is being undertaken.

The Rangert[16] and Rangert et al[17] studies did not differentiate between mesial and distal cantilevers. Small-span restorations in partially dentate arches were considered more vulnerable than those restoring complete arches.[17] In that project, cement-retained telescopic prostheses incorporating a distal cantilever were responsible for most of the complications. Sertgoz and Gunever[18] pointed out that increasing cantilever lengths resulted in greater stress values at the bone-implant interfaces. Distal cantilevered extensions appear to complicate all types of fixed prostheses. Decock et al[19] experienced similar findings in their 18-year longitudinal study of distal cantilevered tooth-supported restorations.

Conclusions

The telescopic principle, long used in tooth-supported restorations, appears to have considerable merit in implant prosthodontics and is worthy of further development. In this investigation, cement-retained implant-supported telescopic prostheses provided a versatile and reliable method of treatment. However, cement-retained telescopic prostheses involving a distal cantilevered extension required the greatest postoperative maintenance.

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