Cement- and Screw-Retained Implant-Supported Prostheses: Up to 10 Years of Follow-up of a New Design

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Purpose: *This retrospective study investigated treatment outcomes over 10 years of a new prosthesis design in implant prosthodontics that uses a combined cement- and screw-retained principle.* ***Materials and Methods:*** *The clinical data of 78 implant-supported prostheses were examined. Each prosthesis incorporated at least 1 screw-retained element and 1 or more cement-retained telescopic units. One hundred twenty-four screw-retained and 161 cement-retained abutments were employed.* ***Results:*** *Of the 286 implants placed, 5 were lost prior to prosthetic loading and 4 (1.4%) were lost approximately 14 months after loading. Eight (2.8%) abutment screws were retightened and 1 gold prosthetic screw was replaced after 1,372 days following fracture. No accidental dislodgment of any prosthesis occurred.* ***Discussion:*** *The introduction of a screw retainer into a series of cement retainers permitted the use of weak cement on the telescopic abutments. This facilitated removal when required while preventing accidental dislodgment. Improved equipment and the learning curve decreased the incidence of abutment screw loosening with time.* ***Conclusion:*** *The ease of retrievability, allied with the security of seating and excellent appearance, makes the combined screw- and cement-retained prosthesis valuable in implant prosthodontics.* INT J ORAL MAXILLOFAC IMPLANTS 2004;19:87–91

Key words: *dental cement, dental implants, dental screws, implant-supported dental prosthesis, osseointegration*

Cement-retained implant-supported fixed prostheses have become an established method of treatment. Implant-supported telescopic prostheses provide design versatility and an esthetic appearance, among other advantages highlighted in previous publications.[1–9] Treatment outcomes have been satisfactory, but accurate seating of the prosthesis on the margins of the inner telescopes can be difficult and the ability to retrieve not always predictable.[3,7] Conversely, and particularly when markedly tapered abutments are employed, the temporary cement occasionally washes out, allowing the prosthesis to loosen.

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In an effort to achieve the predictability of screw retention with the advantage of a telescopic prosthesis, a system was devised in which each telescopic prosthesis incorporated an abutment with a screw-retention unit aligned close to the path of insertion (Fig 1). It was postulated that the screw would assure secure retention, and weak provisional cement would be used to ensure retrievability of the restoration. Furthermore, it was hypothesized that tightening the screw would aid seating, as up to 300 N of load could be applied. In addition, the cement might act as compensation for small discrepancies that inevitably occur with the production of casting. Subsequently, an in vitro biomechanical analysis confirmed this effect, demonstrated the advantages of the seating screw, and highlighted the potential merits of the screw-retained telescopic approach.[10] A pilot study confirmed the clinical effectiveness of the technique, yielding encouraging results.[3]

This study is a retrospective analysis of 78 prostheses, comprising 285 abutments that used the screw- and cement-retained principle, extending up to 10 years in service.

Fig 1 Diagram of a cement- and screw-retained implant-supported prosthesis.

MATERIALS AND METHODS

The clinical data of 78 consecutive prostheses were examined with particular reference to complications involving the supporting implants or abutments. No prosthesis of this design was excluded from this study. Each of the prostheses incorporated at least 1 screw-retained element and 1 or more cement-retained telescopic units.

EsthetiCone (SDCA 134-136), MirusCone (SDCA 419), and 17-degree angulated abutments (DCB414) (Nobel Biocare) were used as screw retainers. DIA, Replace, and TiAdapt (Nobel Biocare) were employed as the abutments for the cement-retained telescopic components.

Prosthesis fabrication was undertaken according to standard clinical protocols.[2] "Single" tooth impression copings (DCA 099, Nobel Biocare) were placed over each implant and the impressions were made in Impregum F (Fabrik Pharmazeutischer Praparate, Seefeld, Germany). Implant analogues were placed on each impression coping, and the impressions were poured to incorporate soft material (Gingifast Zhermack, Pollesine, Italy) around the implant sites. The implant alignments were analyzed on the master cast and the abutments selected.

The telescopic 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 over the implant hexagon in the mouth. The screw-retained abutments were then 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 of the contours of the restoration and screw access holes for the screw retainers. The framework was cast in a gold alloy suitable for high-fusing porcelain. For patients whose implants were placed in type 3 or type 4 bone,[11] a second wax-up was made for an acrylic resin transitional prosthesis. The technique proved useful in finalizing details of appearance and articulation and was later employed for 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. The abutment screws were then tightened. A hand torque wrench (Torque Wrench Hex Insert, Steri-Oss; Nobel Biocare) was used for the DIA, Replace, and TiAdapt abutments. An electronically controlled, motor-driven torque wrench (DEC 601, Nobel Biocare) was used for the EsthetiCone and MirusCone abutments, which were tightened to 20 N/cm. The angulated abutments were hand tightened. Adaptation of the metal framework was checked with Fit Checker (GC America). Occlusal adjustments were made, proximal spaces were checked, and the prosthesis was placed using Temp Bond (Kerr USA) and petroleum jelly as a provisional cement. The prosthesis was seated by hand, and the small prosthetic gold screws in the EsthetiCone abutments were seated and tightened. Excess cement was removed, and patients were seen after 1 day and then 1 week later.

Subsequent examinations were made after further periods of 2 weeks, 1 month, and 3 months and then at 6-month intervals. The prosthesis was removed at the 2-week, 1-month, and 3-month examinations to assess pontic-mucosa relationships, abutment screw tension, and 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. Hygiene maintenance visits were made 1 week later, at 3 months, and then at 6-month intervals.

RESULTS

Seventy-eight screw- and cement-retained prostheses (SCPs) were placed in 44 patients (19 men, 25

Table 1 Relative Age (Time in Service) of Implants

Time in service (y)	No. of implants
0 to 1	5
1 to 2	3
2 to 3	24
3 to 4	3
4 to 5	14
5 to 6	68
6 to 7	45
7 to 8	34
8 to 9	37
9 to 10	37
10 to 11	11
11 to 12	5
Total	286

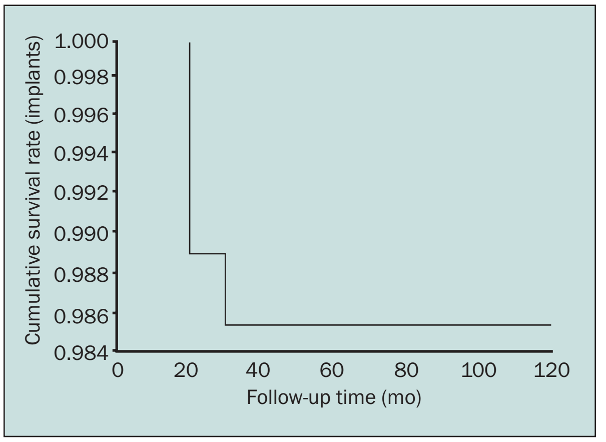

Fig 2 Postloading implant survival plot.

women) with a mean age of 64.2 years. Eleven men and 8 women smoked more than 10 cigarettes per day. Two hundred eighty-six implants were placed, and 5 were lost during the preloading period. Four implants (1.4%) were lost after loading, of which 3 were a cluster loss in 1 female patient who smoked more than 10 cigarettes per day. These failures occurred approximately 14 months postloading. The implants were replaced after a suitable healing period, and a new prosthesis was made as a screw- and cement-retained restoration. The relative age (time in service) of the 286 implants is shown in Table 1. The survival plot as a function of loading time is presented in Fig 2.

Two hundred eighty-five abutments supported the 78 prostheses. One hundred sixty-one cement-retained abutments (153 DIA, 6 TiAdapt, and 2 Replace) and 124 screw-retained abutments (110 EsthetiCone, 2 MirusCone, 11 angulated 17-degree, and 1 standard) were employed. Four abutments were replaced with different designs to improve appearance and were therefore counted twice. Two prostheses in separate patients were involved.

Two of the 78 SCPs included tooth support from minimally tapered gold copings cemented to prepared teeth and covered by the outer prosthesis. No postloading root movement or other complications were noted. Fifteen of the 78 SCPs had distal cantilevers, 6 had a mesial cantilever, and 1 had a double distal cantilever. The first SCP was placed in June 1993, and the last was placed in November 2000. The follow-up extended over 10 years.

Two DIA abutments, 2 EsthetiCone abutments, and 1 angulated 17-degree abutment were reseated at placement of the SCP. Eight (2.8%) of the 285

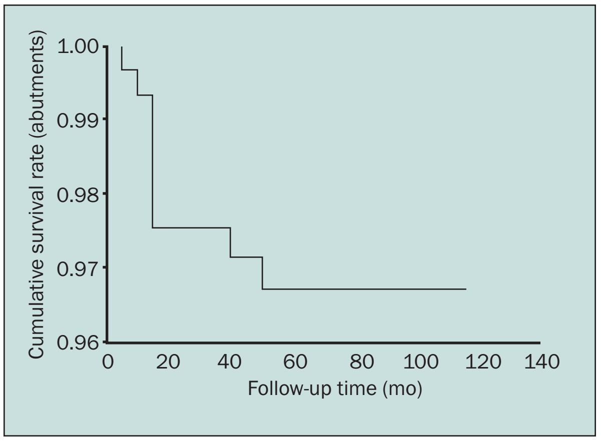

Fig 3 Abutment survival plot.

abutments (4 DIA and 4 EsthetiCone) presented with loose abutment screws at the postinsertion visits. One gold prosthetic screw fractured after 1,372 days of loading and was replaced. One EsthetiCone abutment screw needed a second retightening after a postloading period of 225 days. The survival plot of abutment screws complications is shown in Fig 3. One SCP with a double cantilever suffered porcelain fracture and was replaced for esthetic reasons. One SCP of 9 units was shortened because of failure of a distal abutment (Fig 4).

DISCUSSION

The literature is replete with works extolling the virtues of cement-retained and screw-retained

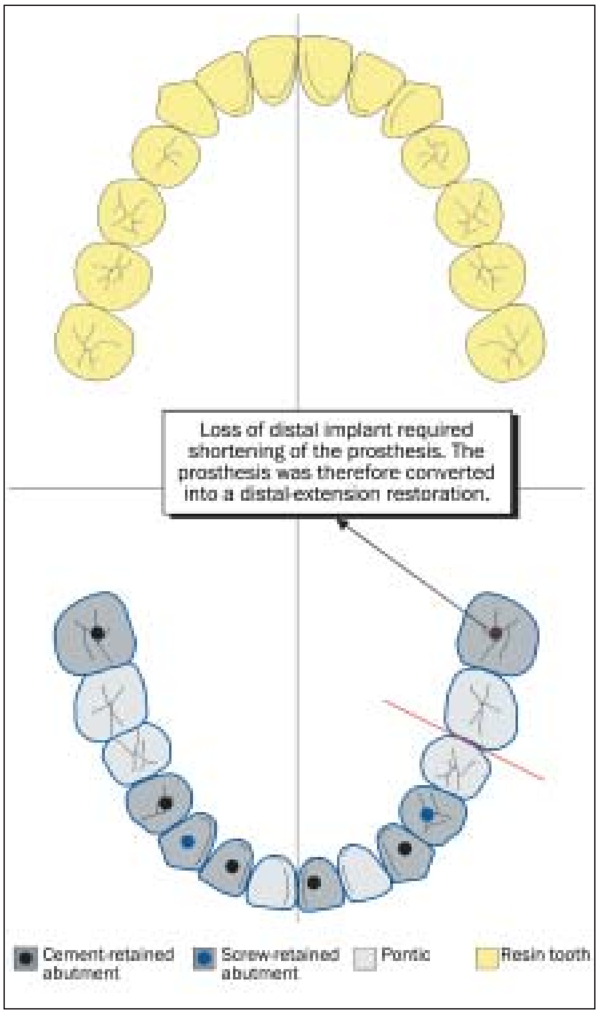

Fig 4 Example of the record of a postloading complication.

restorations,[5,9,12,13] but surprisingly little appears to have been directed to determining the best qualities of each approach.[3,14] The difficulties arising from the need for screw access holes have been illustrated. These include weakening of the substructure, interference with occlusal anatomy, and esthetic complications. These drawbacks are offset by reduced marginal discrepancy and the predictable nature of screw retention. The esthetic advantages and versatility of entirely cement-retained telescopic prostheses have been established together with excellent treatment outcomes, although abutment taper is likely to contribute to accidental dislodgement.[3,5,7,9,13] Dependence upon cement for the retention of a retrievable restoration presents inherent risks. Temporarily luted restorations that loosen are a nuisance to patients and clinicians alike; temporarily luted restorations that cannot be removed when required can be a major problem, particularly when the prosthesis has been incorrectly seated.

The introduction of a screw-retained abutment into a series of cement retainers has been remarkably incident-free. The screw retainer permits the use of weak temporary cement on the telescopic abutments, facilitating removal when required yet ensuring that accidental dislodgment will not occur. From previous studies, the rate of cement washouts ranged from 3.7%[3] to 9.8%.[7] In the present study, no accidental dislodgment of any of the 78 SCPs was experienced in the follow-up period. Furthermore, loosening of abutment screws and gold screws was rare, and the incidence decreased with the passage of time (Fig 3), probably as the result of the introduction of improved torque drivers. These improved drivers might have reduced the incidence of abutment screw loosening (2% to 45%) and of gold prosthetic screw loosening (1% to 38%) seen in earlier studies of screw-retained prostheses.[14] Accidental dislodgment of cemented restorations appears to be relatively rare.[15] The loads transmitted to the abutments may be influenced by the nature of the cement,[16] while in screw-retained prostheses a correlation has been suggested between screw loosening and the inclusion of a distal cantilever.[17]

Distal cantilever extensions in this prosthesis design appeared to be without complications. This is in agreement with the results of an in vitro biomechanical study of an SCP, which showed that the design exhibited a degree of tolerance to misfit, improved load distribution to the supporting implants, and significantly reduced bending moments when load was applied to a distal cantilever extension.[10] However, the load transfer characteristics of temporary cements do not mimic those of more permanent cementing agents, which resemble screw retention systems.[16]

Over the period of the survey, the complications of this prosthesis design were minor, and the rate of complications decreased with time. The combination of cement retainers with screw retainers provided the prosthesis with superior esthetics, enhanced the physical strength of porcelain, and reduced the complexity of laboratory procedures.

CONCLUSIONS

The combination of screw retention with temporary cementation has proven to be a valuable approach to implant-supported fixed prosthodontics in this patient population.

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