sequence of this process, or in other words, to produce an accurate "virtual movie" of the process, the backward transcription of this "movie" will provide the steps necessary for the reconstruction process. This strategy has been followed in the case displayed in Figs 1 to 4.

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# **Overdenture Therapy and Worst-Case Scenarios: Alternative Management Strategies**

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The characteristics of the general population are going to change: according to an epidemiologic projection, in the year 2025 more than 20% of the population in Europe, Japan, and Canada will be over 65 years of age; furthermore, the incidence of complete edentulism will severely increase after 75 year of age.<sup>1</sup> Often, elderly patients have great difficulty adapting to new situations (eg, learning new neuromuscular reflexes for active retention with complete dentures). From an economic point of view, financial power is often decreased after retirement, rendering many of our rehabilitations unacceptable.

It is important to treat completely edentulous patients in a gradual and inexpensive manner. Patients must be able to adapt psychologically and functionally to the new situation. One option to achieve such a result is overdenture treatment on natural teeth. Overdentures have been successfully used for many years and are still considered as a useful treatment modality.<sup>2</sup>

The Glossary of Prosthodontic Terms defines an overdenture as "Any (complete or partial) removable dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth, and/or dental implants; a dental prosthesis that covers and is partially supported by natural teeth, natural tooth roots, and/or dental implants–called also *overlay denture, overlay prosthesis, superimposed prosthesis.*"

The advantages of overdentures can be classified as follows:

- *Psychologic:* Self-image is maintained or even improved (when esthetics are poor before treatment); functional satisfaction is related to number, position, and condition of teeth; some teeth are still preserved.<sup>3</sup>
- *Functional:* Periodontal receptors and denture stability and retention allow occlusal force discrimination to be maintained; masticatory performance and electromyographic activity remain similar to the dentate population<sup>4</sup>; retention of only 2 roots is sufficient to obtain good results.<sup>5</sup>
- *Biologic:* Resorption of the alveolar ridge, which is worsened in complete denture wearers, is extremely diminished; settling and relining of the dentures is reduced.<sup>6</sup>

The possible complications and failures can be classified as follows:

- Tooth decay: Incidence between 6% and 35%; can be controlled by covering the abutments with cast copings, use of bonding agents, thorough oral hygiene, and fluoride and chlorhexidine protection.<sup>7</sup>
- Gingivitis: Incidence between 4% and 13% around the retained roots; can be controlled as reported by Butz-Jorgensen<sup>8</sup>; overlaid roots can be maintained via excellent home care and professional assistance.
- *Endodontic failure:* Ettinger and Qian<sup>9</sup> showed a 12.1% rate of endodontic failure in a 23-year longitudinal study; most common causes were periapical lesions developed on endodontically treated teeth (37%) and vital teeth (19.8%).
- *Vertical root fracture:* Represents 30.9% of overdenture abutment failures and occurs more frequently in the maxilla when opposed by natural teeth.<sup>9</sup>



**Figs 1a to 1c** (a) Patient with worn teeth and diminished vertical dimension of occlusion. The maxillary left incisor and canine with poor alveolar bone can be maintained only for temporary support and to prevent ridge resorption. The occlusal and incisal surfaces of worn teeth can be restored with the metal framework of a removable partial denture with clasps (b). Vertical dimension of occlusion, function, and esthetics can be easily restored using 2 simple and inexpensive removable partial dentures (c).

**Figs 2a and 2b** Periodontal problems are easily manageable with oral care. In this case, a 79-year-old man had difficulty using dental floss and an interproximal brush **(a)**. Denture flange often leaves less space for the tongue **(b)**.

**Figs 3a and 3b** Patient rehabilitated with telescopic copings on maxillary canines and second premolars **(a)** showed an esthetically pleasing outcome **(b)**.



When the remaining teeth are healthy but periodontally compromised (unfavorable quantity of alveolar bone) or in a nonstrategic position, it is inconvenient to use them for retention; however, they can be maintained for transitory support (Fig 1a). Subsequently, once it is impossible to postpone their extraction, denture relining will be easy and inexpensive.

Removable partial dentures are a viable treatment option in cases of loss of vertical dimension of occlusion and tooth wear. The height and morphology of mandibular worn teeth can be restored, at low cost, by a removable partial denture with clasps (Fig 1b). Unfortunately, this treatment offers poor esthetics, but patient satisfaction depends on various factors (eg, age and socioeconomic aspects) (Fig 1c).

Overdentures may be retained by a bar; however, bars may create more periodontal problems (Fig 2a), which can be kept under control with good oral care. Further, bars require more space in the oral cavity, and the required thickness of the flange often leaves less space for the tongue (Fig 2b). When one of the 2 roots has to be extracted, the retainer is also lost.

Tooth-supported telescopic crown-retained dentures present satisfactory outcomes, though they are used less frequently because of the complexity of their fabrication and high cost (Figs 3a and 3b).

The most commonly used and most economic overdenture rehabilitation is the root coping-retained overdenture with female attachments inserted into the flange (Fig 4). Root copings are used for their simplicity, and because the dentures do not need expensive repairs in case of failure. This treatment can be considered as a "social rehabilitation." The best abutment teeth are the canines and first premolars because of their strategic position, while the worst abutment teeth are the molars.



**Fig 4** (*left*) When the vertical space makes it possible to maintain a sufficient thickness for the resin, female attachments can be inserted into the prosthetic flange.

**Fig 5** (*right*) With perio-overdentures, the marginal gingiva is not covered by the resin flange and the abutment teeth are reconstructed anatomically.

**Figs 6a and 6b** A prefabricated gold post with a ball attachment and gold foil (**a**) can be easily adapted on the prepared root in a single session (**b**).

The evolution of overdenture therapy is represented by the perio-overdenture, which was introduced in 1988 to diminish the risk of plaque accumulation and gingivitis.<sup>10</sup> The perio-overdenture differs in the denture base, which does not cover the marginal gingiva; in the anatomic reconstruction of the abutment teeth; and in the open interdental spaces that facilitate oral hygiene (Fig 5).

As with most of the more complex prosthodontic treatments, perio-overdentures are contraindicated when systemic conditions of the patients are compromised, the remaining teeth are in poor condition, the oral hygiene is not sufficient, or the patient's esthetic demands are not realistic. Moreover, because of the high cost of their fabrication, the perio-overdenture cannot be considered a social rehabilitation.

Since elderly patients will need more and more social rehabilitations, a method to decrease the cost of overdenture therapy has been proposed.<sup>11,12</sup> This method uses One-Step Post (Simex), a prefabricate gold post with a ball attachment and gold foil that can be adapted to the root preparation and then cemented in the same session to obtain a coping with an attachment, without the need of a dental technician (Figs 6a and 6b). This procedure presents the following advantages:

- Biologic: Preparing and cementing the post in the same session decreases the risk of bacterial contamination of the root canal treatment (according to the literature, a primary cause of endodontic failures seems to be linked to delayed coronal filling by the posts)
- Economic: Diminishing the operative sessions and not requiring a dental technician reduces the cost

In the implant era, the concept of overdenture therapy is even more popular when applied to titanium roots. Implants seem to have a better prognosis than teeth. Is this true? Can the literature help us make the clinical decision between implants and teeth? In a 2006 study, White<sup>13</sup> concluded that, "Choices between implant and endodontic therapies cannot be solely based on outcomes measurement evidence; broad outcomes data may not be sufficiently specific to directly impact clinical decision making." In another paper, Torabinejad<sup>14</sup> states, "Their duration is similar over time." So, when patients are partially edentulous and retired, with modest financial possibilities, and must be gradually rendered completely edentulous at a low cost, mandible overdentures on implants are preferable only when heroic endodontic/periodonitc treatments and expensive cast copings are needed.<sup>2,15</sup>

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#### Literature Abstract

#### Effect of abutment angulation on the strain on the bone around an implant in the anterior maxilla: A finite element study

This study investigated the strain distribution on the bone around an implant in a simulated anterior maxilla using 2 different abutments with finite element analysis. Two-dimensional finite element models were established for an implant with a straight abutment and a 20-degree angled abutment in the anterior maxilla. The implant used was  $4 \times 13$  mm. The bone bed was designed with a cortical layer thickness of 0.5 mm. Simulated loads of 178 N were applied on the cingulum area. The results showed the following: (1) the greatest strain was found on the cancellous bone, adjacent to the 3 most apical microthreads on the palatal side of the implant; (2) the same strain pattern was noted around both types of abutment; (3) most of the deformation that occurred in the cancellous bone was within physiologic limits, but small areas showed strain beyond the physiologic limit; (4) the model predicted a 15% higher maximum bone strain for the straight abutment compared with the angled abutment. Use of angled abutment in the anterior maxilla may not be a clinical concern in terms of strain.

Saab XE, Griggs JA, Powers JM, Engelmeier R. J Prosthet Dent 2007;97:85–92. References: 49. Reprints: Dr Jason A. Griggs, Baylor College of Dentistry, Texas A&M University System Health Science Center, Department of Biomaterials Science, 3302 Gaston Ave, Dallas, TX 75246. Fax: 214 370 7001—Ansgar Cheng, Singapore

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