

Implant supported mandibular overdenture - a literature review of costs, maintenance and patient satisfaction

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Summary

Objective: this article reviews the literature of costs, maintenance and patient satisfaction for implant supported mandibular overdenture.

Material and methods: a MEDLINE search was completed from 1985 to April 2006, along with a manual search of selected peer-reviewed dental journals to locate relevant English-language articles on implant-supported prosthesis as an alternative to the conventional removable denture.

Results: a total of 360 articles were identified, 110 articles focusing on costs, maintenance requirements and patient satisfaction with implant supported mandibular overdenture were selected and read in their entirety.

Conclusions: while the conventional denture may meet the needs of many patients, others require more retention, stability, function and esthetics, especially in the mandible.

The implant-supported prosthesis is an alternative to the conventional removable denture.

The literature indicates that implant-supported overdentures in the mandible provide predictable results with improved stability, retention, function and patient satisfaction compared with conventional dentures. Implants placed in the anterior mandible have a success rate equal to or greater than 95 percent.

Keywords: overdenture, implant, cost, maintenance, satisfaction.

Edentulism is a public health concern that affects millions of individuals.

The recent literature (Batenburg et al. [1,2], Sadowsky [3]) exhibits a high success rate for mandibular overdentures, with the use of different implant systems and a varying number of implants. Van Steenberghe et al. [4] were among the first authors to propose the placement of only 2 implants in the edentulous mandible. Their 98% success rate, with up to 52 months of observation, was encouraging. The success of using

fewer (generally two) implants has been clearly demonstrated (Mericske-Stern et al. [5]), and intend to become the standard clinical protocol treatment of the edentulous elderly patient in daily practice. Age itself is no longer regarded as a counter indication [6,7], and studies with ITI Straumann implants have demonstrated that mandibular overdentures are highly successful in older patient groups (Mericske-Stern [5]; Schmitt et al. [8]).

It has been shown that implants reduce

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the rate of resorption of the residual ridge in the anterior mandible.

With ideal placement of the implant, the stability of the prosthesis is excellent and the lingual dimensions of the denture can, in some cases, be reduced to the level of mylohyoid line, providing more space for the tongue and greater comfort than with conventional complete dentures.

For patients, a treatment is successful only when oral comfort, chewing ability, self-confidence and appearance are restored to a satisfactory level. Numerous studies have focused on clinical and radiological aspects, but there are several studies describing the effect of dental implants on subjective parameters, including patient satisfaction and psychosocial aspects.

Material and methods

A MEDLINE search was completed from 1985 to April 2006, along with a manual search of selected peer-reviewed dental journals (Clinical Oral Implant Research, International Journal of Oral and Maxillofacial Implants, International Journal of Prosthodontics, Journal of Prosthetic Dentistry) and dental textbooks to locate relevant English-language articles on implant-supported prosthesis.

Results

A total of 360 articles were identified. We searched for the following key words: mandible, overdenture, implants and maintenance (38 articles); mandible, overdenture, implants and costs (30 articles); mandible, overdenture, implants and patient satisfaction (102 articles). 110 articles focusing on costs, maintenance requirements and patient satisfaction with implant supported mandibular overdenture were selected and read in their entirety.

Discussion

Maintenance

All dental care professionals need to be aware of the maintenance care requirements of patients treated with dental implants. With the increased numbers of patients treated there will be greater demands to provide this care in general practices. Maintenance requirements [9] vary widely among patients treated with implant supported prostheses depending upon: susceptibility to caries and periodontal disease in dentate patients, risk factors (smoking and poor diabetic control), occlusal relationship, ability to attain an adequate standard of oral hygiene, complexity and type of implant supported prostheses. It is recommended that patients are seen at least on annual basis, but they also require follow up and routine hygienist treatment at 3, 4 or 6 monthly intervals, according to the individual standard of oral hygiene. The following parameters should be assessed: peri-implant soft tissue health and oral hygiene, marginal bone levels (radiographs), condition of prosthetic replacements, occlusion and hygiene maintenance requirements.

Mericske-Stern proposed a classification of the prosthetic maintenance in the following three categories of problems with implant-supported prosthesis for the edentulous jaw:

- Complications related to implant components: (I) fractures or loosening of abutment; (II) loose or broken screws; (III) fractures of bars; (IV) loose or broken female parts.
- Mechanical and structural failure of prosthesis: (I) resin base fracture; (II) resin tooth/veneer fractures; (III) fabrication of new dentures.
- Maintenance related to adjustments or prosthesis: (I) occlusal correction; (II) relining; (III) problems with design (function, esthetics); (IV) soft tissue problems (stomatitis, hyperplasia) [6].

A distinction between maintenance and complications is a qualitative issue: if normal maintenance service becomes frequent and excessive, it has to be attributed to complications [10].

The consensus of many studies is that maintenance requirements were greatest during the first year of service [11,12,13] and related to alteration of contour and repair of the matrix or patrix. Controversy persists as to whether the bar or ball design requires more maintenance [10]. Some authors found that wear or fracture of the ball attachment head seems less frequent than that of gold alloy bars [14,12]. Many other studies do not support this finding. In a 5-year multicenter study, Watson et al [15], observed, on 127 patients in nine centers over a period of 5 years that replacement of O-rings was reported in 50% of patients, usually within the first year. Clip adjustments and fractures occurred in as many as 62% and 33% of patients, respectively. The shorter the bar segment, the greater the chance of clip loosening in the acrylic resin.

Davis et al. [11], in a study on maintenance requirements in a 3-year period, for thirty seven patients provided with mandibular overdentures stabilized by Astra Tech implants, 13 with ball attachments, 12 with magnet attachments and 12 with bar attachments, concluded that the bar attachment mechanism required 9 episodes of maintenance, compared to 38 for the ball attachment mechanism and 23 for the magnet attachment mechanism. There was no difference between the three groups for the amount of maintenance required by the overdentures.

Naert and coworkers [14], in a 5-year prospective study on 36 patients who received randomly magnets, ball attachments or straight bars on two implants, observed that the Bar group presented the highest retention capacity and the least prosthetic complications but revealed more

mucosities and gingival hyperplasia, whereas unsplinted groups displayed more decubitus ulcers.

In a 5 to 15 years (mean 9.3 yr) observation period on the type of retention mechanism for overdenture connection to the implants (rigid or resilient) for 119 patients, Dudic and Mericske-Stern found that broken, loose, or lost female parts were more frequently observed with resilient devices, as were repairs and relining of the resin denture base, whereas tightening of bar retainers was more typical with rigid bars [10].

The number of complications observed demonstrate the need for post-insertion care, confirming the necessity of routine follow-up services for patients restored with implant-retained overdentures.

Costs

Among many factors considered and compared when studies align conventional denture treatment and implant-retained treatment, cost comparisons are inevitably cited as a high priority consideration in the choice of treatment options.

The total cost of providing mandibular 2-implant overdentures is certainly greater than conventional dentures.

Van der Wijk et al. [16], comparing the costs of two-implant overdenture treatment with those of conventional dentures, found the cost ratio of two-implant mandibular overdentures and new conventional dentures is 3:1 [17,16].

Zitzmann et al [18] performed, from the patient's perspective, a prospective cost-effectiveness analysis comparing overdenture treatment with two or four implants to the conventional complete denture (CD). Twenty patients each were treated with implant-retained overdentures (two implants, IRET), implant-supported overdentures (four implants, ISUP), or CDs (control group) in the edentulous mandible. Direct health-care costs were calculated in Swiss Francs (in 2000), and effects were

defined as improvements in perceived chewing ability compared with the baseline value before treatment. The evaluation was made for 6 months. The authors of the study concluded that: from an economic point of view, IRETs were more attractive than ISUPs. The latter were associated with a statistically significant improvement in perceived chewing ability compared to CDs, but at substantially higher costs.

Attard et al. [19], analyzing long-term costs in 90 edentulous patients treated with mandibular implant-supported prostheses (fixed or overdenture) concluded that the mandibular overdenture was a less expensive treatment compared to the fixed implant prosthesis.

Takanashi et al. [20] compares the cost of mandibular two-implant overdenture treatment to that of conventional denture treatment in an academic teaching hospital on sixty edentulous patients (aged 65 to 75 years) participated in a randomized clinical trial.

All patients received a new maxillary complete denture and either a mandibular conventional denture (n = 30) or an implant overdenture on two unsplinted implants (n = 30). Resource-based microcosting of direct and indirect costs (eg, expenses and time cost to patients) of all scheduled and unscheduled visits was conducted through 1 year following delivery of the prostheses.

Results

Mean direct costs (in 1999) for scheduled visits in the implant and conventional groups were 2,332 Canadian dollars and 814 Canadian dollars, respectively, and mean indirect costs were 1,150 dollars and 810 dollars, respectively. Differences between the two groups were significant. Twenty-six patients in each group had unscheduled visits during the study at a median direct cost for the overdentures of 85 Canadian dollars and 64 Canadian dollars for the convention-

al dentures. Median indirect costs for unscheduled visits were 163 dollars and 202 dollars, respectively. These differences were not significant. Mean total costs of the overdentures were 4,245 dollars and 2,316 dollars for the conventional dentures, and the between-group difference was significant. The conclusion of the study was that the direct cost of mandibular two-implant overdenture treatment was 2.4 times higher than that of conventional denture treatment. When indirect costs were added, the implant-to-conventional total cost ratio estimate was 1.8. These cost data should be combined with estimates of the efficacy of the two types of prosthesis so practitioners and patients can make informed decisions about these prosthodontic treatment concepts.

According to Carpanieri J. [21], the two-implant mandibular overdenture provides greater retention than does a conventional mandibular denture despite to the greater cost and, due to its efficiency, can significantly improve the quality of life of the edentulous patient.

Patient satisfaction

Numerous authors have addressed patient general satisfaction, "prosthesis stability", "retention" and "function" with the mandibular implant overdenture using the help of questionnaires [3].

Quiryne et al. [22] comparing fixed full prostheses (FFPs) and overdentures (ODs), determined patient satisfaction using two questionnaires often used for this type of evaluation. The first questionnaire had the following parts: the first one included questions in which the patients gave their answers on an ordered analogue scale with numbers ranging from 1 (very bad) to 9 (excellent); the second part included questions that had to be answered with a yes/no response; the third part demanded a more descriptive answer. The second questionnaire was based on a visual analogue scale

(VAS), in which patients gave their answers as a crossed mark on a scale from 0 to 100 (low/worst to high/best). Patient satisfaction was very high for both types of prosthetic rehabilitation. The FFP group scored only slightly better for chewing comfort and general satisfaction.

Meijer et al. [23] found that, after 5 years, patients with mandibular overdentures retained by 2 implants interforaminaly had higher satisfaction scores than complete denture patients.

Raghoobar et al. [24] confirmed this finding in another randomized study, comparing 3 treatment options: meticulous construction of a new set of dentures (CD), construction of a new set of dentures following preprosthetic surgery to enlarge the denture-bearing area (PPS), and construction of an implant-retained mandibular overdenture (IRO).

De Grandmont et al. [25] used a within-subject cross-over trial compared psychometric and functional measurements on 15 edentulous patients to evaluate whether fixed or removable implant-supported mandibular prostheses, placed on four to five implants, are more satisfactory for the patient. The scores given after a 2-month period for both types of prostheses did not differ significantly with regard to general satisfaction, esthetics, and ability to speak and to chew.

Feine et al. [26] also studied the same group and reported that almost 50% of the patients who chose the mandibular bar-retained overdenture (selected by 7 elderly subjects) did so because it was easier to clean. For better stability and chewing ability, younger subjects tended to prefer the fixed prostheses design (chosen by 8 subjects).

In a crossover study designed by Burns and coworkers [27], patients compared two-implant overdentures retained on magnet-attachments with those retained on O-rings

after wearing each system for six months. Although all subjects were generally satisfied with both attachment systems, most patients preferred the O-ring attachments.

Naert et al. [14], in a study including 36 fully edentulous patients, randomly divided into three groups according to the attachment system, who received: magnets (Dyna, Bergen op Zoom, Netherlands), ball attachments (SDCB 115-17, Nobel Biocare) or ovoid bars (reference group), after 5 years of observation concluded that patient satisfaction rated similar for all groups, although the Magnet group showed lower retention forces. All patients would repeat the same treatment even though the majority of the Magnet group would prefer a more retentive solution because of limited denture stability.

Wismeijer et al. [28], in a randomized study, investigated 110 edentulous patients who had received mandibular implant overdenture treatment with 1 of the following: 2 implants with ball attachments, 2 implants with an interconnecting bar, or 4 interconnected implants. Most of the implants were at least 10 mm long. An improvement in patients' satisfaction before and after treatment was found in all cases when comparing their ability of food comminution, prosthesis function and retention. However, no significant differences were found between the three groups and almost all subjects expressed satisfaction.

Because a substantial percentage of the patients (up to 35%) reported considerable retention of food under their lower (over)denture, it is important to inform them about this phenomenon before treatment [22].

Numerous studies and clinical trials have demonstrated the viability, safety, superior functional performance and patient satisfaction with the implant-retained and tissue-supported mandibular overdenture, when compared to the conventional removable denture.

Conclusions

The high success rate, usefulness, and reliability of the implant supported mandibular overdentures have been demonstrated and it is a well-established and reliable treatment option, especially for the elderly edentulous patients.

The implant-retained overdenture should reduce stress on patients and tissues, and it is a treatment modality that should be less time-consuming, less expensive, will minimize risks on patients and tissues, and become a true alternative to fixed prostheses.

Despite the fact that the total cost of providing mandibular 2-implant overdentures is certainly greater than conventional dentures it has been shown that this treatment modality is a well-established and reliable option.

Knowledge, educational background, cultural issues, financial means and adapta-

tive capacity influence patient acceptance of a particular treatment modality. There is no evidence for a single, universally superior treatment modality for edentulous mandible. Each treatment modality can produce a successful outcome for the treatment in a chosen individual. Clinicians should avoid applying one universal treatment intervention. Choice of treatment modality should evaluate both-dentist and patient-mediated factors, including treatment and maintenance costs.

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