

Patient Responses to Dental Implant-retained Mandibular Overdenture Therapy: A 6-year Clinical Study

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Background: The purpose of this study was to record subjective patient experiences with respect to the surgical placement of dental implants and the functioning of mandibular implant-retained overdentures versus conventional dentures.

Methods: Completely edentulous patients (n = 56) unable to wear a conventional mandibular complete denture were each treated with 4 one-stage titanium plasma sprayed or Sandblasted Large-grit Acid-etched (SLA) screw implants and overdentures retained by a cast bar with extracoronary attachments. Fifty-six patients were subsequently clinically evaluated over a period of up to 6 years. Fifty-three patients responded to questions on their experiences prior to and after treatment with implant retained overdentures.

Results: No implants or restorations failed during the observation period. Most of the patients (96%) felt satisfied with their new overdentures, and reported their new dentures fit comfortably.

Conclusions: The use of implants to retain and support the denture improved comfort, giving the patients more self-confidence and improved social interaction, in addition to oral rehabilitation. This study demonstrates rehabilitation of the mandibular arch with an implant-retained overdenture is a predictable treatment protocol.

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Key words: dental implants, overdenture

Tooth loss results in progressive resorption of the alveolar ridge, which may be especially debilitating to the patient who has worn a mandibular complete denture for a period of time. As the alveolar ridge resorbs, stability and retention of the denture prosthesis diminishes, resulting in a reduction of comfort, chewing ability, biting force, and facial esthetics. These factors lead to general dissatisfaction with the mandibular prosthesis, causing the patient to seek a replacement denture. In the past, these patients were treated primarily with preprosthetic surgery, such as vestibuloplasty, a surgical pro-

cedure that increases the effective height of the alveolar ridge by lowering the tissue attached to the bone, or ridge augmentation.^(1,2)

More recently, implant-retained dentures have been used in these patients. Considerable research has been done with respect to dental implants, mainly in the areas of biocompatibility,^(3,4) osseointegration,⁽⁵⁻⁷⁾ and implant design.⁽⁸⁻¹²⁾ Few published studies have taken patient views into account.^(13,14) The purpose of this study, in addition to routine clinical evaluation, was to obtain insight into patients' experiences with the surgical treatment and functioning of

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implant-retained dentures.

Many completely edentulous patients with severe resorption of the mandibular alveolar ridge present to the Chang Gung Memorial Hospital for complete denture service when their general practitioner is unable to satisfy their expectations. Treatment planning for these patients is done by a prosthodontist and a periodontist, who together examine the oral condition of each patient and determine whether implants in the mandible are indicated and possible.

Patients diagnosed with ill-fitting dentures have new conventional dentures fabricated by the prosthodontist. If the patient remains dissatisfied, treatment with an implant-retained overdenture is considered. A total of 56 patients receiving a mandibular overdenture supported by an implant-retained cast bar and extracoronar attachments were clinically evaluated. A total of 53 patients returned a questionnaire surveying their experiences with conventional and implant retained dentures.

METHODS

In this study, 224 implants were inserted into the mandibles of 56 edentulous patients by one periodontist at Chang Gung Memorial Hospital in Taiwan from 1999 to 2005. Twenty-four of the 56 patients were men and 32 were women, with a mean age of 54.6 years. The duration between denture insertion and the study follow-up averaged 19 months (Table 1), and ranged from 6 to 57 months.

Computerized tomography was used for evaluation of potential mandibular implant placement sites. The implants used were either one-stage titanium plasma sprayed (TPS) or Sandblasted Large-grit Acid-etched (SLA) Straumann screws. (Straumann Institute, Waldenburg, Switzerland)^(5,6,9,15) All

implants were 3.3, 4.1, or 4.8 mm in diameter and ranged in length from 10 to 12 mm. Using local anesthesia, a total of four implants were placed bilaterally in each patient at the mandibular canine and first premolar regions.

Subsequently, a customized cast bar (58.3% silver-25% palladium alloy, Electra; Ivoclar Vivadent, Amherst, NY, USA) with two distal extracoronar resilient attachments (AMP Sterngold, PA, USA) was fabricated to retain the mandibular overdenture (Fig. 1). Each patient received a new conventional maxillary complete denture and a mandibular implant-retained complete overdenture (Fig. 2) made with bilaterally balanced articulation 10 to 12 weeks after implant placement. The dentures were made by one prosthodontist. The patients were evaluated immediately after denture insertion and every 3 months thereafter by the prosthodontist and periodontist.



Fig. 1 A customized cast bar with two distal extracoronar resilient attachments was fabricated to retain the mandibular overdenture.



Fig. 2 A new conventional maxillary complete denture and a mandibular implant-retained complete overdenture.

Table 1. Duration of Denture Use (1999-2005)

Number of months	Number of patients
6-9	12
10-19	15
20-29	13
30-39	10
40-59	6
Mean = 19 months	Total = 56 patients

At each recall appointment the bar was cleaned, if necessary, with appropriate instruments (i.e. interproximal brush). During these visits, pocket depths around the implants were measured and oral hygiene was evaluated. The cast bar retainer was removed. Osseointegration of the implants was clinically determined to have occurred if there was no gross mobility with digital palpation, bone loss or periimplant radiolucency, and if percussion of the implants with the blunt handle of a dental mirror resulted in a bright ringing sound. Periapical and panoramic films (for evaluation of bone changes around the implants) were taken at 6, 12, and 24 months (Fig. 3).

To evaluate patient experiences, a questionnaire was developed with pre-coded answers in five categories:

1. Patient's experience with previous dentures.
2. Patient's experience with surgical procedures.
3. Patient's opinion of oral hygiene.
4. Patient's opinion of new dentures.
5. Patient's opinion of his or her social life.

Questionnaires were completed anonymously by the patients 3 months after the treatment was done. Three patients who received the questionnaire did not return it. Therefore, a total of 53 patients remained available for the study. Questions comparing patient experiences with the new implant-supported overdentures and previous conventional dentures were designed to be answered independently as either "Yes" (favorable) or "No" (unfavorable) for each set of dentures. Proportions of paired responses between conventional and implant retained dentures were analyzed for each question with McNemar's



Fig. 3 Panoramic film taken at 24 months to evaluate bone changes around the implants.

test with Yate's correction for continuity ($\alpha = .05$).⁽¹⁶⁾ The null hypothesis was that the patients perceived no subjective differences between the new and previous dentures.

RESULTS

None of the 224 implants placed during the period from 1999 to 2005 failed and all were clinically osseointegrated. Thus, the implant survival rate after treatment was 100%. Survival of the overdenture restoration was also 100%.

Pocket depth measurements ranged between 1 and 3 mm. However, several patients had gingival hyperplasia which led to pseudo-pocket formation. A gingivectomy was performed if the gingiva had proliferated against the bar or the sulcus could not be kept clean. Radiographs obtained after 6, 12, and 24 months demonstrated no significant changes in bone level. During the evaluation period, three dentures required replacement of the Extracoronary Resilient Attachment matrix component because of loss of retention.

One of the 53 patients reported that the implant placement procedure was painful. Fifty-four percent of the patients expected more discomfort after the procedure than they actually experienced. At the time of follow-up, 63% of the patients never felt pain at the implant site, but 37% experienced some pain (Table 2).

During the first 2 to 4 weeks after surgery, the patients were asked not to wear their existing mandibular denture. While 66% of the respondents did not experience this as a problem, 34% of the patients, all women, did not appreciate this consequence of the treatment.

Answers to questions concerning oral hygiene are reported in Table 3. Most of the patients used a toothbrush and dental floss for implant hygiene. An

Table 2. Response to Questions - Implant Surgical Procedure

Question	Yes	No
Was the implant surgery painful?	1%	99%
Did you feel more discomfort after the procedure than you actually expected?	46%	54%
At the time of follow-up after surgery, did you feel pain?	37%	63%

Table 3. Positive Responses - Oral Hygiene

Question	Previous dentures N = 53	New dentures N = 53	<i>p</i>
Do you clean your dentures more than once a day?*	65% (34)	98% (52)	< .0001
Do you clean your dentures with a special brush, soap, and water?*	74% (39)	96% (51)	< .0015
Do you clean your implants with			
– toothbrush?		87% (46)	
– dental floss?		83% (44)	
– interproximal brush?		75% (40)	

*: McNemar's test ($\alpha = .05$)

often-heard complaint (but not a question in the questionnaire) was that it was not easy to clean the bar and the implants. Many patients also objected to the frequency of regular visits.

Responses on the functioning of the new dentures compared to the old dentures can be seen in Table 4. Dental comfort improved after implant therapy. The most apparent results of treatment were the

decrease in pain under the mandibular denture and the improvement in denture stability during function. Eighty-eight percent of the respondents would advise others to undergo similar treatment if needed, whereas only 2% definitely would not.

Questions concerning patients' social lives are listed in Table 5. The social lives of a significant number of respondents in regard to visiting friends

Table 4. Positive Responses - Oral Function

Question		Previous denture N = 53	New denture N = 53	<i>p</i>
Do you always wear your mandibular denture during the day?*		81% (43)	100% (53)	.0044
Do you wear your mandibular denture while sleeping?*		34% (18)	36% (19)	1.0
Do you hardly ever feel pain under your denture?*	Maxillary	73% (39)	89% (47)	.0133
	Mandibular	12% (6)	85% (45)	< .0001
Does your denture stay in place during function?*	Maxillary	75% (40)	93% (49)	< .0077
	Mandibular	8% (4)	95% (50)	< .0001
Can you eat well with your dentures?*		15% (8)	96% (51)	< .0010
Do you ever use an adhesive to keep your denture in place?*	Maxillary	14% (7)	2% (1)	.0200
	Mandibular	27% (14)	2% (1)	.0009
Does your denture have a precise fit?*		65% (34)	96% (51)	< .0001
Do your maxillary and mandibular dentures fit well together?*		62% (33)	94% (50)	< .0001
Are you satisfied with your dentures?*	Maxillary	72% (38)	94% (50)	.0015
	Mandibular	6% (3)	96% (51)	< .0001

*: McNemar's test ($\alpha = .05$)

Table 5. Positive Responses - Social Conditions

Questions	Previous dentures N = 53	New dentures N = 53	<i>p</i>
Can you speak easily while wearing your dentures?*	31% (16)	92% (49)	< .0001
Can people understand you when you speak to them?*	43% (23)	96% (51)	< .0001
Do you like your facial appearance with your dentures in place?*	45% (24)	98% (52)	< .0001
Do you visit your family while wearing your dentures?*	79% (42)	99% (52)	.0120
Do you visit your friends and go to parties while wearing your dentures?*	57% (30)	99% (52)	< .0001
Do you laugh fully while wearing your dentures?*	28% (15)	93% (49)	< .0001

*: McNemar's test ($\alpha = .05$)

and family appeared to be influenced by their dentures. The implant retained overdenture treatment improved their social interaction.

DISCUSSION

The implant survival rate of 100% (after an average duration of 19 months after insertion) is comparable to results reported by other researchers using the TPS system.^(5,15) During this time no implants exhibited gross mobility, horizontal bone loss greater than 1 mm, pain, infection, or periimplant radiolucency.

The use of pocket measurements with a probe as a parameter for implant success is disputable because of questionable accuracy. Because there is no periodontal ligament, there is no precise depth reference.⁽¹⁷⁾ Moreover, there is a risk of penetrating the epithelial attachment.⁽¹⁸⁾ Thus, pocket status only gives a general impression of peri-implant status. Presently, objective analysis of osseointegration using dynamic methods is not universally accepted, although evidence of the usefulness of such methods is increasing.^(19,20)

The high rate of general satisfaction with retention and stability of the mandibular overdenture used in this study in particular can be explained by the fact that it is retained to the cast bar with extracoronary resilient attachments. The high percentage of patients who said they rarely felt pain under their mandibular overdenture (85%) is presumably a result of the fact that the implant-retained bar limits movement of the overdenture over the tissues and provides relief to the alveolar mucosa of the mandible.⁽¹⁰⁾ Because of positive results in the mandible, some patients requested a similar prosthesis in the maxilla, although they initially did not complain about the maxillary denture.

A somewhat negative effect encountered was that patients were not allowed to wear their mandibular denture for 2 to 4 weeks after implant placement. This treatment strategy was based on a study reporting that a period of minimal occlusal loading is necessary for optimal osseointegration.⁽⁹⁾ This consequence was judged very controversial by the patients. Thirty-four percent of the respondents, all women, did not like this aspect of the treatment. However, because of the much greater comfort they experienced with the new dentures, their opinion

afterward was that this was not unbearable. The need to maintain a lengthy unloaded period may be questioned. Babbush⁽⁶⁾ and Babbush et al.,⁽¹⁵⁾ for example, placed dentures within a few weeks after implantation and reported a similar implant survival rate.

The patients treated in this study were selected primarily because of chronic dissatisfaction with mandibular conventional dentures. If this same study were done with individuals well-adapted to conventional denture wear, the results might be different. However, the functional and social rehabilitation perceived by this group of patients is impressive. These data show that a poorly fitting prosthesis before treatment was conducive to social isolation. The use of implants improved denture comfort and stability. Thus in addition to oral rehabilitation, patients had more self-confidence and social interaction.

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病患對人工植牙支持下顎全口覆蓋性義齒之六年臨床調查研究

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背景： 此研究乃是針對人工植牙支持下顎活動覆蓋性義齒，除了臨床評估之外，更根據病患的經驗作手術治療及義齒功能、美觀及影響社交的統計調查，藉以瞭解人工植牙支持活動覆蓋性義齒與傳統全口活動假牙之比較。

方法： 56 位全口無牙之病患在六年之內接受 224 支人工植牙於下顎犬齒及第一小白齒區之種植，上顎傳統全口活動假牙及下顎人工植牙支持活動覆蓋性義齒製作完畢後，作臨床評估及完成配戴經驗之問卷調查與統計。

結果： 結果顯示在六年之中未有任何一支人工植牙失敗，大部份的病患(96%)對於人工植牙支持覆蓋性義齒是絕對滿意的，同時密合度也比傳統全口假牙要好得多。

結論： 使用人工植牙於活動義齒之設計可改善義齒的穩定度，並給予病患較大的舒適感，增加其自信心與社交經驗。因此，人工植牙支持覆蓋性活動義齒是一種可預期的治療模式。

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關鍵詞： 人工植牙，下顎活動覆蓋性義齒

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