

# A PROSPECTIVE 2-YEAR CLINICAL EVALUATION OF OVERDENTURES ATTACHED TO NONSPLINTED IMPLANTS UTILIZING ERA ATTACHMENTS

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*Edentulism is a major oral healthcare issue for an ever-increasing older population in the United States. Most previous studies examined the success of overdentures supported by splinted implants utilizing clip bars and other types of attachments. This longitudinal study of 10 consecutive patients involves mandibular overdentures supported by nonsplinted implants with ERA attachments. Two-year results indicate that nonsplinted implants can be successfully used with ERA attachments to support overdentures. Each patient reported increased satisfaction with comfort, chewing, retention, and phonetics with the implant-assisted ERA-retained overdenture.*

**Key Words:** overdenture, ERA attachment, implant

Studies have evaluated the value of implant-supported prostheses compared to conventional denture treatment in which the patients' views are taken into account. Bloomberg and Lindquist reported patient reaction prior

to and following placement of fixed prostheses.<sup>1</sup> The majority of the patients reported improvement in quality of life, self-confidence, and acceptance of the prosthesis. Few studies have been reported on patient reaction to implant-supported overdentures.<sup>2,3</sup> Results showed that the majority of patients were satisfied with their clip bar retained overdentures. Geertman et al compared patient reaction to implant-supported overdentures with those of an implant-tissue-supported overdenture.<sup>4</sup> While the difference with respect to satisfaction, complaints, and subjective chewing ability were not significant, both groups were aided by implants. The purpose of the present study was to prospectively attain patients' responses to overdentures supported by ERA attachments on nonsplinted implants.

## Materials and Methods

This study included 10 completely edentulous patients (6 females; 4 males) with a mean age of 64.4 years (range of 50 to 84). Patients were selected from those presenting at the Ashman Department of Implant Dentistry,

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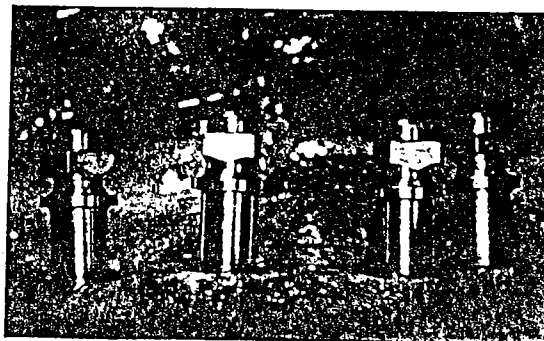


Figure 1. Four commercially pure titanium implants were placed between the mental foramina (minimum length of 10 mm).

Kriser Dental Center of New York University. All were edentulous for more than 1 year, and all complained about their existing mandibular dentures or were unable to wear a complete denture. Patients were explained the nature of the study and expressed a desire to participate. They were given a written consent form (approved by the University Committee on Activities Involving Human Subjects), which they signed prior to their participation in the study. Those excluded from the study included all patients who would — for either systemic reasons or anatomic limitations — not be a candidate for implant placement. Any patient in this category was presented with an alternate treatment.

Prior to treatment, the medical status, preoperative panoramic radiograph, and dental history of each patient were recorded. The initial oral examination consisted of a head and neck evaluation as well as analysis of the existing dentures — including the presence of any dysfunctional concerns. A questionnaire concerning the patient's satisfaction level with their existing dentures was obtained (Tables 1 and 2). Each patient had a new set of complete dentures constructed and adjusted. After completion of all adjustments, implants were placed.

Each patient had four screw-shaped commercially pure titanium implants (Implamed Sterngold, Amleboro, MA) placed anterior to the mental foramen according to Brånemark's surgical protocols (Figures 1 and 2). All implants were a minimum of 10 mm in length. Patients were placed on antibiotics (penicillin 1g/day for 1 week) beginning 1 hour prior to surgery or erythromycin (1g/day for 1 week) in penicillin-allergic patients. Chlorhexidine rinses (Peridex, Omnii Products, West Palm Beach, FL) were prescribed for 2 weeks following surgery. Sutures were removed 1 week postsurgery. Patients were advised not to wear their dentures whenever possible for 2 to 3 weeks following implant placement. The denture was then relined so as not to impinge on the implant sites and to avoid transmucosal loading. The denture was periodically checked during the healing period and adjusted as necessary. Following 4 to 6 months of healing, osseointegration was confirmed by the absence of

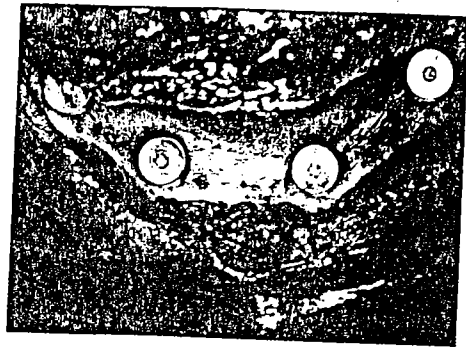


Figure 2. The implants were evenly distributed antero-posteriorly.



Figure 3. Abutments were placed according to tissue height following second-stage surgery.

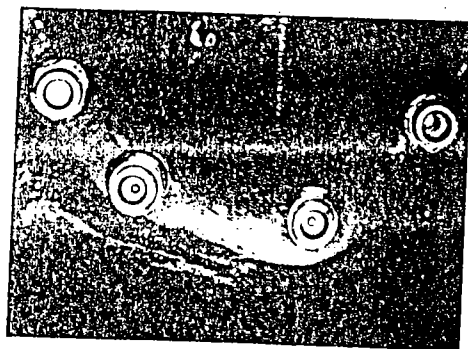


Figure 4. An angled abutment was used to achieve parallelism.



Figure 5. Metal jackets were subsequently placed on the abutments.

Table 1

Patient Questionnaire	
1.	How many times per day do you clean your denture? (0), (1), (2), (3), (4~)
2.	How long do you wear your lower denture during the day? (0 hr), (0~2 hr), (2~4 hr), (4 hr~12 hr), (12 hr~24 hr)
3.	Do you also wear your lower denture during the night? (yes), (no)
4.	Do you feel pain under your denture? (0~10) _____
5.	Does your denture stay in place during function? (0~10) _____
6.	Are you comfortable with your lower denture? (0~10) _____
7.	Do you use an adhesive to keep your denture in place? (0~10) _____
8.	How well does your lower denture fit (without adhesive)? (0~10) _____
9.	Do your upper and lower dentures fit well together? (0~10) _____
10.	Are you satisfied with your lower denture? (0~10) _____
11.	How well do speak easily with your dentures? (0~10) _____
12.	How well do people understand you when you speak? (0~10) _____
13.	How happy are you with your facial appearance with your dentures in place? (0~10) _____
14.	Do you feel comfortable with your social life with your dentures? (0~10) _____

pain, mobility, and radiographic evidence of radiolucency. Transmucosal healing abutments were placed. Four to 6 weeks later, ERA abutment selection was made according to the healed gingival depth. Angulated abutments were selected, if necessary, to establish parallelism (Figures 3 and 4). A small amount of self-curing resin was painted on the metal housing of the male portion of the ERA in order to facilitate its placement into the denture (Figures 5 and 6). All of the implants were utilized individually with no splinting (Figures 7 through 9).

At each follow-up visit, the following were recorded:

1. Loosening of the attachment to the abutment.
2. Replacement of the plastic retentive element.
3. Changes in occlusion.

Follow-up visits occurred at 6, 12, 18, and 24 months after prosthetic completion. Twelve months following delivery of the final implant-supported overdenture, a patient interview with subjective evaluation was repeated (Table 3). Patients were not aware of their previous answers and scores prior to implant treatment. All patients were followed during the entire observation period.

## Results

### Implant Failures

Of the 40 implants placed, two implants failed (one in each of two patients), which resulted in an implant success rate of 95%. The two failures occurred at the time

Table 2

		Preprosthetic Patient Results (by Question)													
Before		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	KB	3	5	1	3	1	5	10	3	10	6	10	10	10	10
2	MI	4	4	0	5	5	3	10	2	8	2	10	10	10	7
3	HC	5	5	0	4	0	0	10	0	2	0	5	5	5	0
4	MM	2	5	1	2	3	1	1	1	1	0	1	3	5	3
5	ME	4	4	0	8	2	0	0	2	8	2	8	10	6	6
6	SM	3	5	1	0	0	6	0	3	0	0	5	5	8	3
7	HH	2	5	0	0	0	0	0	0	0	0	0	5	0	0
8	YY	5	4	0	0	5	3	0	3	3	0	3	8	0	3
9	ME	5	5	0	0	4	4	9	4	10	10	10	10	10	5
10	WG	4	5	0	3	2	0	2	0	2	0	2	3	3	2
Average		3.7	4.7	0.3	2.5	2.2	2.2	4.2	1.8	4.4	2	5.4	6.9	5.7	3.9

of abutment placement surgery. The implants were not replaced, and in these two patients the complete dentures were supported by three nonsplinted implants without further complications. No implant failed after loading or during the 2-year observation period.

**Prosthetic Outcome**

One patient's denture fractured and was remade with a metal-based overdenture. Over the 2-year period of observation, there were five occasions in three patients where the male retentive portion of the ERA required changing due to looseness or wear.

**Patient Satisfaction**

An evaluation of patient satisfaction was obtained from a questionnaire concerning general satisfaction, phonetics, aesthetics, and improved function and ability to retain the denture (Figure 10). The marked improvement in denture stability (Question 5), denture comfort (Question 6), denture satisfaction (Question 10), and social life (Question 14) were recorded.

**Discussion**

Many reports confirmed the high levels of success for some implant systems with implant-retained mandibular overdentures,<sup>7,13</sup> while other systems revealed a high incidence of failures.<sup>16</sup> Osseointegration, as a highly successful

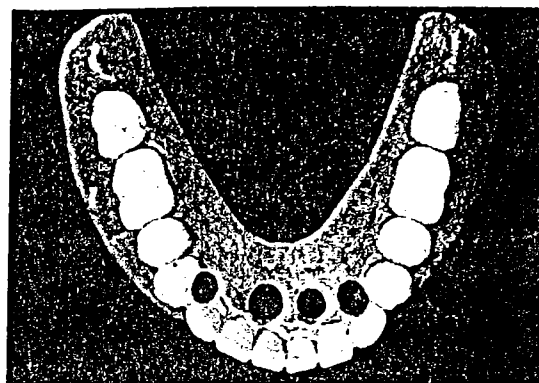


Figure 6. Occlusal view of the prosthesis with corresponding spaces for implant retention.

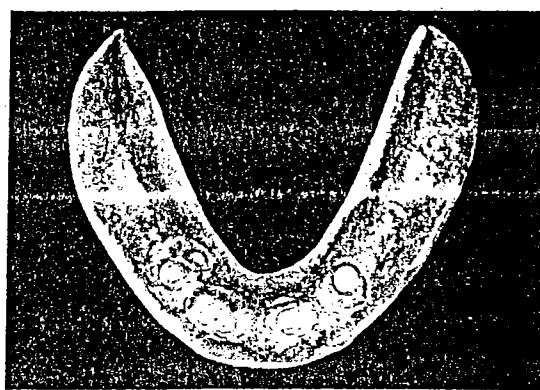


Figure 7. Tissue-colored self-curing resin was utilized to aesthetically mask the metal implant jacket.

clinical intervention, provides the basis for various prosthetic rehabilitation strategies for the completely edentulous patient. Some strategies include the use of two implants to support overdentures. It has been reported

Table 3

		Postprosthetic Patient Results (by Question)													
After		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	KB	3	5	1	0	10	10	0	10	10	10	10	10	8	10
2	MI	3	5	0	0	10	9	0	10	8	8	10	10	8	10
3	HC	5	5	1	0	10	10	0	10	10	10	10	10	10	10
4	MM	3	5	1	7	8	7	0	10	5	5	10	10	10	10
5	ME	3	5	1	8	9	9	0	9	9	9	8	7	4	5
6	SM	4	5	1	0	10	10	0	10	10	10	10	10	10	10
7	HH	2	5	0	0	10	8	0	8	8	8	10	10	10	10
8	YY	4	5	0	0	10	10	0	0	8	10	10	10	9	10
9	ME	4	5	1	0	10	10	0	10	10	10	10	10	10	10
10	WG	4	5	1	0	9	10	0	9	10	10	10	10	9	10
<b>Average</b>		<b>3.5</b>	<b>5</b>	<b>0.7</b>	<b>1.5</b>	<b>9.6</b>	<b>9.3</b>	<b>0</b>	<b>8.6</b>	<b>8.8</b>	<b>9</b>	<b>9.7</b>	<b>9.5</b>	<b>8.8</b>	<b>9.5</b>

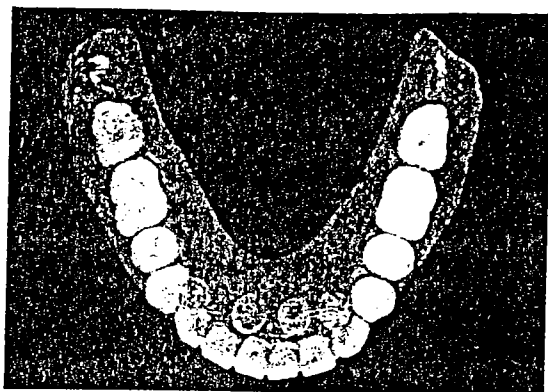


Figure 8. Occlusal view of the completed restoration.

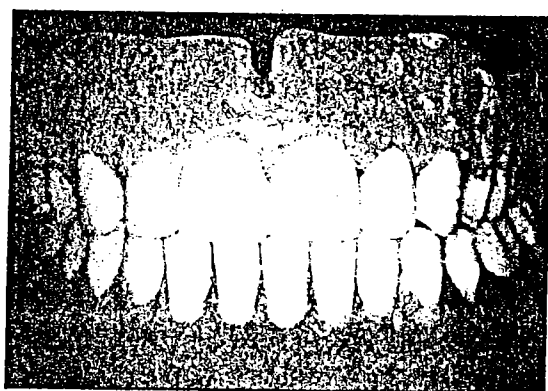


Figure 9. Maxillary complete denture and mandibular implant-supported overdenture.

that loaded, osseointegrated, root-form implants under mandibular overdentures have implant survival rates of 97% to 100%.<sup>7</sup> The success rate of 95% recorded in the present study is similar to those reported.

The present study demonstrated clear advantages to the use of an implant-assisted, nonsplinted ERA-retained overdenture compared to a conventional complete denture. Patient satisfaction was improved along with denture retention and ability to function. The fact that nonsplinted implants could be utilized without apparent difficulty is an advantage in expense and time savings. From a clinical perspective, nonsplinting of implants reduces the need for the interocclusal space necessary with a cast bar, and hygiene is more easily accomplished by the patient for better implant maintenance. In addition, replacement of worn or loose individual attachments is more easily accomplished than when they are connected to a splinted bar.

Patient satisfaction was improved with ERA overdentures. There was a significant increase in the patients' satisfaction with the retention of the denture during function. There was a significant increase in patient comfort with the mandibular denture and a corresponding decrease in the use of denture adhesives (which was eliminated). There was a higher satisfaction level with the occlusion of the prostheses, as well as an improvement in others' ability to understand the patients' speech. Most importantly, patients had a significant overall appreciation for increased comfort and confidence in social life.

A disadvantage of the system is the potential need for an adjustment in the angulation of the female portion of the ERA depending upon how the implant was placed. The use of an angled abutment also requires

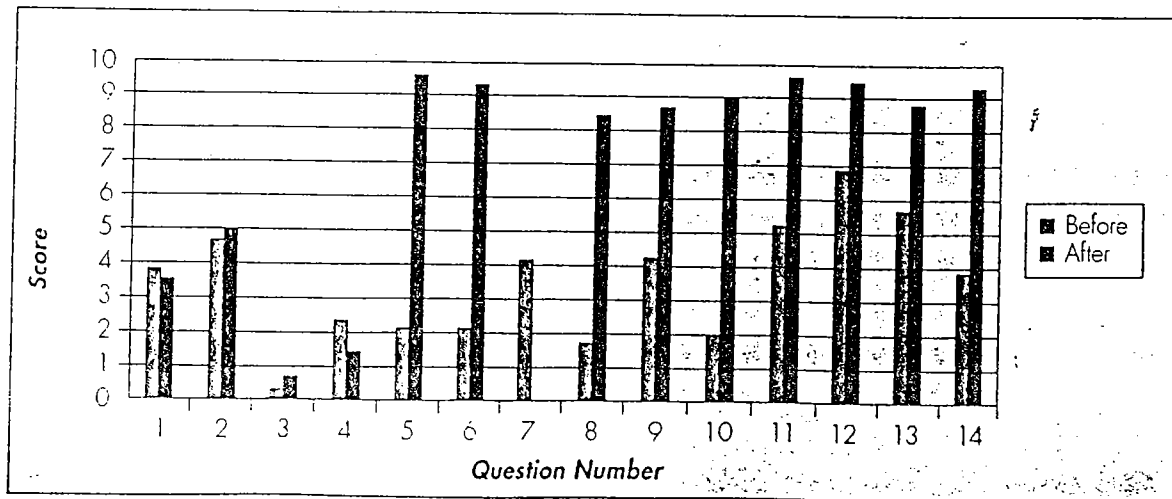


Figure 10. Comparison of preprosthetic (Table 2) and postprosthetic (Table 3) patient evaluation.

additional vertical space, and the system is more technique sensitive when angled abutments are necessary. It is, therefore, advisable that every effort be made in the surgical placement phase of treatment to place the implants parallel to each other.

When considering general patient satisfaction, no significant differences appeared between splinted and nonsplinted implants according to Naert's 5-year study.<sup>18</sup> The bar-retained patients had more hyperplasia and mucositis; in nonsplinted patients, this was not evident. It was also reported that mucositis and ulcer decubitus continued to be present in the same patients throughout the 5 years, while hyperplasia was observed in more patients over time for splinted cases.<sup>15</sup> In this study there was no sign of hyperplasia, mucositis, or other complications.

The next investigation should determine whether or not it is possible to place implants and attach ERA attachments to a patient's existing denture. Admittedly, the old denture may have various deficiencies compared to new dentures. It may be possible, however, to help these patients with less treatment, at a lower cost, and still afford them increased comfort and function. Another area for future investigation is whether two implants placed in the canine regions, nonsplinted, will be sufficient for the same long-term success as four implants were in this study.

### Conclusions

In this study of 10 patients over 2 years, implant success (95%) and prosthetic success (100%) were comparable to overdentures placed on splinted implants in previously reported studies. Moreover, there was no apparent difference in implant health and success between splinted cases in other studies and nonsplinted cases using ERA attachments in this study. There is also an additional advantage in that patient hygiene was better maintained with nonsplinted implants. This study included patients who had new complete dentures fabricated. Each of the 10 patients reported increased satisfaction with the retention, comfort, ability to function, and speech with an implant-assisted ERA-retained overdenture compared to their previous complete denture.

### References

1. Bloomberg S, Lindquist LW. Psychological reactions to edentulousness and treatment with jawbone-anchored bridges. *Acta Psychiatr Scand* 1983;68(4):251-262.
2. Hoogstraten J, Lamers LM. Patient satisfaction after insertion of an osseointegrated implant bridge. *J Oral Rehab* 1987;14(5):481-487.
3. van Waas MA, Bosker H. Evaluation of satisfaction of denture wearers with the transmandibular implant. *J Oral Maxillofac Surg* 1989;18(3):145-147.
4. Wismeijer D, Vermeeren JJ, van Waas MA. Patient satisfaction with overdentures supported by crestal TPS implants. *Int J Oral Maxillofac Impl* 1992;7(1):51-55.
5. Clancy JM, Buchs AU, Ardjmand F. A retrospective analysis of one implant system in an oral surgery practice. Phase I: Patient satisfaction. *J Prosthet Dent* 1991;65(2):265-271.
6. Geertman ME, van Waas MA, van't Hof MA, Kalk W. Denture satisfaction in a comparative study of implant-retained mandibular overdentures: A randomized clinical trial. *Int J Oral Maxillofac Impl* 1996;11(2):194-200.
7. Mericske-Stern R, Zarb GA. Overdentures: An alternative implant methodology for edentulous patients. *Int J Prosthodont* 1993;6(2):203-208.
8. Burns DR, Unger JW, Elswick RK Jr, Beck DA. Prospective clinical evaluation of mandibular implant overdenture: Part I—Retention, stability, and tissue response. *J Prosthet Dent* 1995;73(4):354-363.
9. Burns DR, Unger JW, Elswick RK Jr, Gaglio JA. Prospective clinical evaluation of mandibular implant overdentures: Part II—Patient satisfaction and preference. *J Prosthet Dent* 1995;73(4):364-369.
10. Engquist B, Bergendall T, Kallus T, Liden U. A retrospective multicenter evaluation of osseointegrated implants supporting overdentures. *Int J Oral Maxillofac Impl* 1988;3(2):129-134.
11. Naert I, De Clercq M, Theuniers G, Schepers E. Overdentures supported by osseointegrated fixtures for the edentulous mandible: A 2.5-year report. *Int J Oral Maxillofac Impl* 1988;3(3):191-196.
12. Mericske-Stern R. Clinical evaluation of overdenture restorations supported by osseointegrated titanium implants: A retrospective study. *Int J Oral Maxillofac Impl* 1990;5(4):375-383.
13. Arvidson K, Bystedt H, Frykholm A, et al. A 3-year clinical study of Astra dental implants in the treatment of edentulous mandibles. *Int J Oral Maxillofac Impl* 1992;7(3):321-329.
14. Naert I, Quirynen M, Hooghe M, van Steenberghe D. A comparative prospective study of splinted and unsplinted Brånemark implants in mandibular overdenture therapy: A preliminary report. *J Prosthet Dent* 1994;71(5):436-442.
15. Jemt T, Harnett J, Heath MR, et al. A 5-year prospective multicenter follow-up report on overdentures supported by osseointegrated implants. *Int J Oral Maxillofac Impl* 1996;11(3):291-298.
16. Versteegh PA, van Beek GJ, Slagter AP, Ottervanger JP. Clinical evaluation of mandibular overdentures supported by multiple-bar fabrication: A follow-up study of two implant systems. *Int J Oral Maxillofac Impl* 1995;10(5):595-603.
17. Chao YL, Meijer HJ, van't Hof MA, Versteegh PA. The incomprehensible success of the implant-stabilized overdenture in the edentulous mandible. A literature review on transfer of chewing forces to bone surrounding implants. *Eur J Prosthodont Rest Dent* 1995;3(5):255-261.
18. Naert I, Gizani S, Vuylsteke M, van Steenberghe D. A 5-year prospective randomized clinical trial on the influence of splinted and unsplinted oral implants retaining a mandibular overdenture. Prosthetic aspects and patient satisfaction. *J Oral Rehab* 1999;26(3):195-202.