



## Clinical Performance of Implant Overdenture Versus Fixed Detachable Prosthesis

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### ABSTRACT

**Aim:** To evaluate the satisfaction of completely edentulous patients with a different number of implants to retain removable and support the fixed prosthesis.

**Materials and methods:** Fifty patients with the single edentulous ridge (maxilla or mandible) were selected for this study and divided equally into five groups. Each group contained 10 patients. Group 1: conventional complete denture (negative control group), group 2: two implants retained overdenture, group 3: three implants retained overdenture, group 4: four implants retained overdenture, group 5: fixed detachable prosthesis with five implants placed between the mental foramen. After one year from completing the treatment, the patients were requested to fill a specially designed questionnaire to assess their overall quality of life and level of satisfaction, both aesthetically and functionally. Comparison of data between groups was performed using the Chi-square tests. The level of statistical significance was considered at  $p < 0.05$ .

**Results:** Patients treated with conventional complete denture were all unsatisfied in their masticatory function, and 80% were also unsatisfied in phonetics, while only 50% of patients were satisfied aesthetically and mentally and 70% were satisfied in social life. The addition of two or more dental implants resulted in 100% satisfaction in the variables tested. There was no statistical difference between the number of implants and supra-structure design regarding patients' satisfaction. Furthermore, implants retained overdenture and fixed detachable prosthesis design scored the same satisfactory level.

**Conclusion:** The satisfaction level of the conventional complete denture in the treatment of an edentulous arch can be dramatically improved by adding dental implants and changing the design to an overdenture. Two implants with an overdenture design is a valid treatment option for the edentulous arch as

well as three and four implants. Fixed detachable prosthesis did not add any further patient satisfaction when compared to implant retained overdenture.

**Clinical significance:** Two implants with overdenture to treat edentulous jaw is effective as five implant fixed prosthesis.

**Keywords:** Number of implants, Overdenture, Patientsatisfaction, Prosthesis design.

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**Conflict of interest:** None

### INTRODUCTION

Complete-denture wearers frequently report problems with oral function due to loss of retention and stability especially the mandibular prosthesis.

The use of dental implants improves the oral rehabilitation of edentulous patients when using a removable or fixed dental prosthesis. Deciding between fixed and removable prosthesis depends on several factors such as the inter-arch space available and relationship, intra-foraminal distance, cost and patient's preference.<sup>1</sup> Implant supported overdentures (ISOD) are now considered a standard treatment of choice in an edentulous arch.<sup>2</sup> They are considered less complicated, financially affordable and less invasive with more predictable and satisfactory results in patients complaining from stability and retention with conventional dentures<sup>1</sup>.

It has been documented that a great number of edentulous patients prefer fixed prosthesis than a removable one.<sup>3</sup> Many difficulties are encountered when treating an edentulous arch with a fixed prosthesis. Factors including lack of lip support, problems with speech, patient's oral hygiene and excessive facial cantilevering should be considered as it may complicate the treatment with a fixed prosthesis.<sup>3</sup> Another main element that must

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be identified during treatment planning is the space from crestal bone to the occlusal plane, as a minimum of 13 to 14 mm is needed when planning for an implant-supported fixed prosthesis and bar overdentures. On the other hand, locator attached overdentures necessitate at least 8.5 mm.<sup>3</sup> Comparing ISOD with fixed detachable prosthesis in terms of esthetics, ease of cleaning, speech, and patient satisfaction, and all were in favor of ISOD.<sup>4</sup> Additionally, decrease the number of implants, less complicated surgical and laboratory procedures were also advantages of ISOD.<sup>5</sup>

Several consequences associated with single conventional complete denture lead to pain, residual bone resorption and inefficient mastication that can be avoided with implant supported overdentures.<sup>6</sup> Alternative treatment with ISOD with one implant in the mandible is suggested, which contributes to more retentive features compared to a complete denture.<sup>7</sup> However, multiple risks could encounter when treating with a single midline implant during the surgical procedure and the chance of fracture may increase due to stress concentrated around the single implant.<sup>8</sup> Nevertheless, overdentures with a single implant appear to be cost-effective, less invasive with more predictable results. In certain situations, increasing the number of implants might be required to increase the retention in a patient with the prominent mylohyoid ridge, atrophic ridge, high muscle attachment or with severe gagging reflex; also patients with mandibular soreness and pain would benefit by increasing the number of implants.<sup>9</sup> In a recent study, the least complications were showing implant supported overdentures with two implants.<sup>10</sup>

In some cases, increasing the number of the implant to three or four is desired to overcome the denture rotation under loading compared to two implants and when increased retention is also needed.<sup>11</sup> Concerning stresses around the implant site, a four implants model demonstrated less stress than two implants in all directions of loading.<sup>12</sup> While clinical and radiographical data revealed no difference between two and four implants.<sup>9</sup>

## OBJECTIVES

The aim of the study was to evaluate the patients' satisfaction with a different number of implants retained removable and support the fixed prosthesis. The variables assessed improved the quality of patient's mastication, phonetic, aesthetic and quality of life.

## MATERIALS AND METHODS

### Patient Selection

Patients attending a private clinic having maxillary or/and mandibular edentulous arches and requiring edentulous arch rehabilitation prosthesis with either conventional complete denture or implant-retained mandibular overdenture with at least two implants as their treatment plan were asked to participate in this study.

Patients were examined clinically and radiographically by an experienced periodontist and selected according to an inclusion and exclusion criterion listed in Table 1. Consent was obtained from the patients who agreed to participate before commencing the treatment.

### Sample Size

A total of 50 patients were included and divided equally into five groups. Their age ranged from 40 to 60 years old. Patients were assigned to the following groups:

- *Group 1:* Conventional complete denture
- *Group 2:* Two implant-retained mandibular overdentures
- *Group 3:* Three implant-retained mandibular overdentures
- *Group 4:* Four implant-retained mandibular overdenture
- *Group 5:* Five implants supporting fixed detachable prosthesis

The total number of edentulous arches treated with the implant was 40 arches (37 mandibles and 3 maxilla) and 10 edentulous arches (6 mandibles 4 maxilla) was left without implant treatment to serve as negative control.

**Table 1:** Inclusion and exclusion criteria

<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
1. No general medical risks, for example, previous or current radiotherapy or chemotherapy, osteoporosis, or current bisphosphonate therapy	1. Insufficient bone to place 5 implants in the maxillary or mandibular arch
2. Absence of soft or hard tissue inflammation in the oral cavity	2. Acute or Chronic symptoms of TMDs
3. Adequate oral hygiene	3. Systemic or neurologic disease that contraindicate implant surgery
4. Complete upper jaw edentulism or complete edentulism for lower jaw > 5 years	4. Other health conditions such as alcoholism, or smoking more than 1 pack of cigarettes/day
5. Ability to understand and respond to the scales used in the study	5. Psychologic or psychiatric conditions that could influence a participant's reaction to treatment

## Surgical Procedure

In this study, a total of 140 implants (ITI Straumann Basel Switzerland) were distributed to four groups (groups 2 to 5), and 10 conventional complete dentures were fabricated according to a standard prosthetic treatment protocol as group 1. Two implants were placed at a canine position in group 2 (Fig. 1). Three implants used in group 3 (Fig. 2), in which two were placed at the canine position and one at the central incisor position. In group 4, four implants were placed at canine and premolar area (Fig. 3). Finally, five implants were placed between the mental foramen in group 5 (Fig. 4).

Prosthetic rehabilitation procedures were initiated after the three months of the osseointegration period with the same prosthodontist. Group 2 to 4 were restored with implant retained tissue supported overdenture

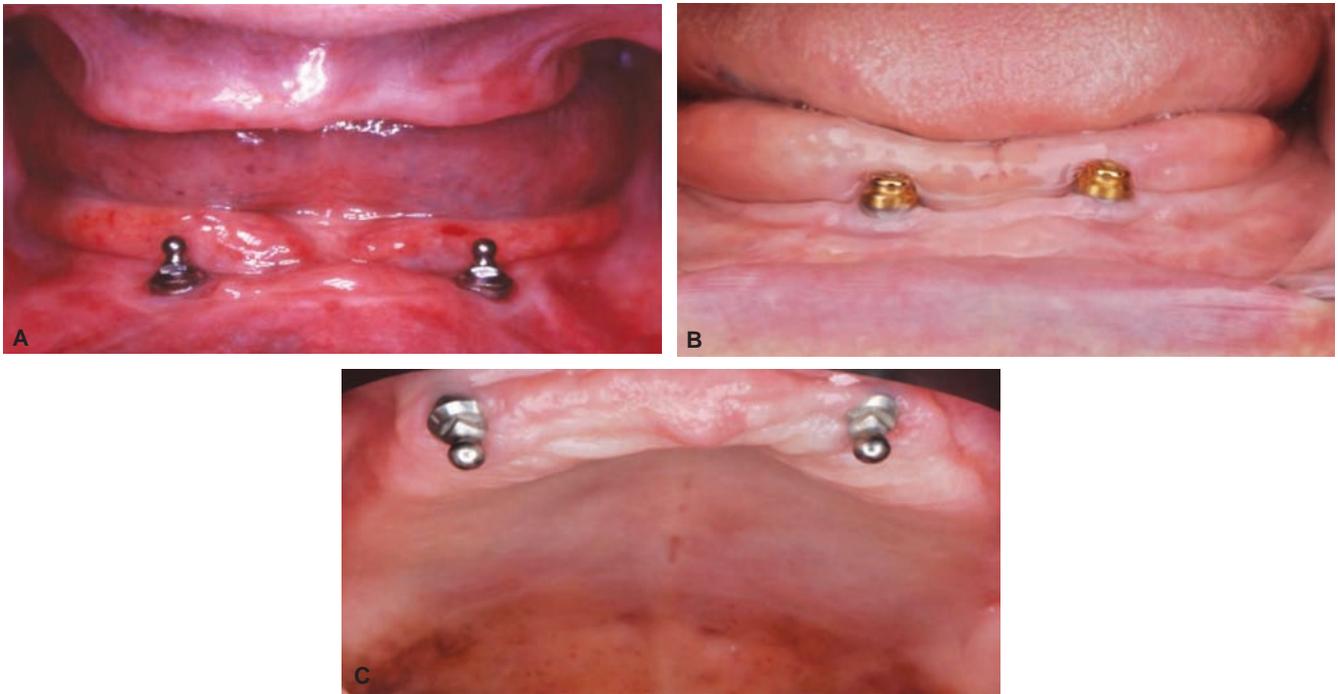
while group 5 restored with fixed detachable prosthesis delivered with cantilever design posteriorly.

## Patient Satisfaction and Measurements

The questionnaires used were modified and translated into Arabic from a previously published work (Table 2).<sup>13</sup> Evaluating patient's satisfaction towards a denture can be evaluated from different aspects. The first aspect is the masticatory ability of the denture during function and with different types of foods. The second aspect is the problems from the denture itself; as those problems that complicate the denture usage. The third aspect is the overall prosthesis performance and its impact on daily life.<sup>13</sup> An extensive self-estimated questionnaire was developed covering all aspects said earlier. The questionnaire is categorized into seven categories, and

**Table 2:** Patient questionnaire

1	<i>Evaluation of Patient's satisfaction</i>	2	<i>Evaluation of Patient's complaining during function</i>
1-1	Did you feel that your chewing or swallowing has worsened easily because of problems with dentures?	2-1	Did your denture loosen easily when talking?
1-2	Did you feel food impact under your denture easily?	2-2	Did your denture loosen easily when eating?
1-3	Have you had to interrupt your meal because of your denture?	2-3	Did your denture cause pain or sore spot when eating?
		2-4	Did you find your denture or teeth clicking when eating or talking?
		2-5	Did you feel insecure with your denture when eating?
		2-6	Did you feel difficult to swallow liquid food?
		2-7	Did you experience difficulty when chewing?
3	<i>Evaluation of masticatory ability in different types of foods</i>	4	<i>Evaluation of patient's phonetics satisfaction</i>
3-1	Did you find it uncomfortable to eat any type of food because of problems with your dentures?	4-1	Have you had trouble pronouncing any words due to your denture?
3-2	Can you eat soft food with your denture? (example: mashed potato, lasagna, pastries...etc.)	4-2	Trouble pronouncing the letter S?
3-3	Can you eat hard food with your denture? (example: chicken, meat, piece of bread...etc.)	4-3	Trouble pronouncing the letter TH?
3-4	Can you eat stiff food with your denture? (example: nuts, carrots...etc.)	4-4	Trouble pronouncing the letter T?
3-5	Can you eat sticky food with your denture? (example: toffy, candies...etc.)	4-5	Trouble pronouncing the letter F&V?
5	<i>Evaluation of patient's aesthetic satisfaction</i>	6	<i>Effects on mental daily life</i>
5-1	Are you satisfied with the color of the denture?	6-1	Have you been self-conscious because of your dentures?
5-2	Are you satisfied with the color of your teeth?	6-2	Have you been upset because of problems with your dentures?
5-3	Are you satisfied with the shape of your teeth?	6-3	Have you found it difficult to relax because of problems with your dentures?
5-4	Are you satisfied with the shape of your facial appearance?	6-4	Has your sleep been interrupted because of problems with your dentures?
5-5	Are you satisfied with your smile?	6-5	Have you been unable to brush your teeth properly because of problems with your dentures? (fixed vs. removable)
7	<i>Effects on social daily life</i>		
7-1	Have you suffered any financial loss because of problems with your dentures?	7-2	Have you been unable to work to your full capacity because of problems with your dentures?
7-3	Have you avoided going out because of problems with your dentures?	7-4	Have dental problems made you miserable?
7-5	Have you been a bit irritable with other people because of problems of your denture?		



**Figs. 1A to C:** Two Implants and ball attachment in the mandible; (B) Two Implants with locator attachment in the mandible; (C) Two Implants with ball attachment in the maxilla



**Fig. 2:** Three implants with ball attachment in the mandible



**Fig. 3:** Three implants with ball locator in the maxilla



**Fig. 4:** Five Implants with fixed detachable prosthesis

- *Category 5:* Evaluation of the patient's aesthetic satisfaction
- *Category 6:* Effects on mental daily life
- *Category 7:* Effects on social daily life

**Statistical Analysis**

Questionnaires were given to the patient after one year of their prosthetic rehabilitation. A scoring system was performed to analyze the data according to the response of patients. A score 1 was given as 'satisfied', score 2 for 'sometimes' and score 3 for 'unsatisfactory' response. Within each category, the responses were summed and given values ranged from 5 to 15. Values ranged from 5 to 7 were determined as the satisfactory response of the patient in the whole category, from 8 to 12 were valued as 'sometimes' and unsatisfactory values ranged from 13 to 15 within the same category. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) ver. 22.0 (SPSS Inc., Chicago, IL, USA). A Chi-Square test was used at a significance level of 5% ( $p < 0.05$ ).

each category contains specific questions with a score given to each answer, which can be calculated and subjected to further analysis. These categories include:

- *Category 1:* Evaluation of patient's mastication satisfaction
- *Category 2:* Evaluation of patient's complaining during mastication
- *Category 3:* Evaluation of masticatory ability on different types of foods
- *Category 4:* Evaluation of patient's phonetics satisfaction

## RESULTS

The results showed that conventional treatment with complete denture for the edentulous patient has led to incomplete satisfaction. All patients who received conventional treatment with complete denture reported unsatisfactory results in masticatory function and the treatment did not reach their expectation, 80% were unsatisfied in phonetics with a conventional complete denture. Also, only 50% of patients were satisfied in both aesthetics and mental daily life and 70% in social life. However, the results showed that the addition of two or more dental implants resulted in a 100% satisfaction in the variables tested using with statistically significant differences between groups,  $p < 0.05$  (Table 3).

Comparison between the number of implants and supra-structure design showed no statistical difference between a number of implants nor the design regarding patient satisfaction using the aforementioned statistical methodology. This indicates two, three or four implants with overdenture design had the same satisfactory level. Furthermore, when comparing implants overdenture design (irrelevant to a number of implants) to the fixed detachable prosthesis design, both have scored the same satisfactory level (100% satisfaction) using the previous test method.

## DISCUSSION

Complete denture retention and stability can influence the patient's ability to function and are

intimately and directly related to patient confidence and comfort.

Using dental implants for restoring edentulous mandibular ridges show superior effects on patient's satisfaction in both masticatory and esthetic restoration.<sup>14</sup>

Retention is a key factor for the success of complete denture treatment. Lack of retention is the most frequent problem with existing conventional complete dentures. This handicaps the patient both in mastication and in social situations due to fear of losing the dentures.<sup>15</sup> Patients with no previous denture experience were included to eliminate any muscles adaptation.<sup>16</sup> The choice of the anterior mandibular region (the interforaminal region) was advocated because implants should intimately engage dense cortical bone at their apical and crestal aspect to exhibit primary stability needed for successful osseointegration.

Moreover, the greatest available height of bone is located in the anterior mandibular area between the mental foramina. This region usually presents the optimal density of bone for implant support. It is entirely formed of dense thick cortical plates and dense trabecular bone.<sup>17,18</sup> While placing dental implants retaining maxillary overdenture was found to be favorable in the canine-premolar area to reduce the possibility of endangering the maxillary sinus.<sup>19</sup>

The mandibular two-implant overdenture is a simple and effective solution and leads to significant improvement of patient-based outcomes as compared

**Table 3:** Results

Variable		Groups as per the number of implants					p-value
		Group 1	Group 2	Group 3	Group 4	Group 5	
Evaluation of patient's mastication satisfaction	Satisfied	0.0%	100%	100%	100%	100%	<0.001
	Sometimes	100%	0.0%	0.0%	0.0%	0.0%	
	Unsatisfied	0.0%	0.0%	0.0%	0.0%	0.0%	
Evaluation of patient's complaints during mastication	Satisfied	0.0%	80%	100%	100%	100%	<0.001
	Sometimes	90%	20%	0.0%	0.0%	0.0%	
	Unsatisfied	10%	0.0%	0.0%	0.0%	0.0%	
Evaluation of masticatory ability in different types of foods	Satisfied	0.0%	90%	100%	90%	100%	<0.001
	Sometimes	40%	10%	0.0%	10%	0.0%	
	Unsatisfied	60%	0.0%	0.0%	0.0%	0.0%	
Evaluation of patient's phonetics satisfaction	Satisfied	20%	100%	100%	100%	100%	<0.001
	Sometimes	80%	0.0%	0.0%	0.0%	0.0%	
	Unsatisfied	0.0%	0.0%	0.0%	0.0%	0.0%	
Evaluation of patient's aesthetic satisfaction	Satisfied	50%	90%	100%	100%	100%	0.02
	Sometimes	40%	10%	0.0%	0.0%	0.0%	
	Unsatisfied	10%	0.0%	0.0%	0.0%	0.0%	
Effect on mental daily life	Satisfied	50%	100%	100%	100%	100%	<0.001
	Sometimes	50%	0.0%	0.0%	0.0%	0.0%	
	Unsatisfied	0.0%	0.0%	0.0%	0.0%	0.0%	
Effect on social daily life	Satisfied	70%	100%	100%	100%	100%	0.01
	Sometimes	30%	0.0%	0.0%	0.0%	0.0%	
	Unsatisfied	0.0%	0.0%	0.0%	0.0%	0.0%	

to conventional dentures.<sup>15</sup> Using written assessment questionnaires as a guide to the exact patient satisfaction rate toward a prosthetic treatment are widely used nowadays in clinical trials and studies to evaluating the treatment outcomes, and many studies highlight the psychosocial impacts of oral conditions.<sup>20-22</sup>

Although ball and socket attachment was selected to be used in our study. However, lack of appropriate inter-arch space in some clinical cases have led us to use the locator attachment which has been reported to be clinically effective in many reports. That was found to be matching with Mahrous et al.<sup>23</sup> who mentioned that the implant supported overdentures restored by locator attachment shows better effects on bone in cases of limited inter-arch spaces in mandibular.

The results of this study agreed with Kende et al.<sup>24</sup> who reported the positive returns of the fixed prosthesis against the conventional complete dentures in treating edentulous patients. Also, the results were found to be matching with Awad et al.<sup>25</sup> as the patients treated with overdentures over two implants showed high satisfaction rates. But he neglected the effect of increasing the supporting implants number retaining the overdenture in relation to the satisfaction rates.

On the contrary, in those patients treated with 3 and 4 implants supporting an overdenture the results agreed with Krennmair et al.<sup>26</sup> who mentioned that the treatment outcomes and its reflection on patient satisfaction were found to be equal whether the overdenture is retained by 4, 6 or even 8 implants anchored either on an anterior or on 2 bilaterally placed milled bars.

The results of the statistical analysis of those patients treated with the fixed detachable prosthesis were found to be in concert with Bolouri et al.<sup>3</sup> regarding the comparison with conventional complete denture while the results showed no significance between the other groups.

Finally, due to the difficulty in recruiting an edentulous patient, we have included only fifty patients. However larger sample size with longer follow up period is highly recommended in the future study.

## CONCLUSION

The satisfactory level of the conventional complete denture in the treatment of edentulous arch can be considerably improved by adding dental implants and changing the design to an overdenture. Two implants with an overdenture design is a valid treatment option for edentulous arch compared with three or four implants. Fixed detachable prosthesis did not add any further patient satisfaction when compared to implant retained overdenture.

## CLINICAL SIGNIFICANCE

Fixed detachable prosthesis did not add any further patient satisfaction when compared to implant retained overdenture. Two implants with an overdenture design is a valid treatment option for edentulous arch compared with three or four implants.

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