



*Oral Health-Related Quality of Life (OHRQoL) with maxillary and mandibular Dentures supported by implants inserted according to “ALL-ON-FOUR” concept (Fixed versus Milled Bar Overdenture concept)*



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**Abstract:**

**Objectives:** The aim of this study was the assessment and comparison of Oral Health-Related Quality of Life (OHRQoL) with maxillary and mandibular Dentures supported by four implants inserted according to ‘All-on-Four® Concept (fixed dentures versus milled bar overdentures)

**Materials and methods:** Six edentulous patients were selected, each patient received four implants in the maxilla and four implants in the mandible; two implants in canine area and two implants in second premolar area. Three patients received implant supported screw-retained fixed prosthesis and the other three patients received a milled-bar overdenture. (Oral Health-Related Quality of Life) “OHRQoL” evaluation by OHIP-14 questionnaire consisted of 14-items divided into seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap.

**Results:** Comparing OHIP scores for all questions (items) for all groups, there was a significant difference in all questions of OHIP between groups except question 12 (difficulty in doing jobs). Comparing OHIP scores for all domains and total OHIP score for all groups, there was a significant difference in all domains and in total OHIP score between groups. In multiple comparison between each 2 groups there was a significant difference between CD and FP and between CD and MB for all items, all domains and total OHIP score. However, no significant difference was noted between FP and MB for all items, all domains and total OHIP score

**Conclusion:**

**Introduction**

The two implant mandibular overdentures was considered the standard of care for edentulous patients. Implant supported overdentures improve retention, stability, patient satisfaction compared to conventional dentures<sup>1-39</sup> The “All-on-four” concept was developed and widely analyzed in the 1990s through studies by Paulo Maló<sup>40</sup> that was funded by Nobel Biocare. It include rehabilitation of the edentulous maxilla and mandible with fixed prosthesis by placing four implants in the anterior region, where bone density is higher. The four implants support a fixed prosthesis with 12 teeth and loaded immediately on the same day of surgery.<sup>41</sup> This concept involve using only four implants to support the prosthesis; two axially anterior implants and two distally tilted posterior implants, the All-on-Four® treatment concept used to rehabilitate edentulous arches with immediately loaded fixed prosthesis on the same day of surgery.<sup>40, 41</sup> Tilting the distal implants gives some great advantages as: reducing the cantilever length, implant can be anchored in the cortical bone of the sinus wall and nasal fossa improving its osseointegration and stability.<sup>42</sup> increasing the inter-implant distance, allows for better load distribution, maximize the use of the available bone with no need for bone augmentation allowing immediate loading.<sup>40, 43</sup> it also allow using longer implants which help increasing the implant primary stability due to increased bone-to-implant surface area.<sup>44</sup> prosthetic options for “all-on-four” treatment concept include milled bar overdenture and fixed prostheses

**Implant supported over-denture** shows improved stability, retention and offers considerable functional and psychosocial enhancement compared to conventional

one.<sup>45</sup> The McGill<sup>46</sup> consensus statement in 2002 stated that mandibular two-implant overdentures are minimum treatment care for edentulous patients, however, technical and biological complications may occur.<sup>47, 48</sup> Successful overdenture treatment can also be provided for the maxilla depending on some factors which influence implants and prosthesis success as : quality and quantity of remaining bone, and the number and location of implants.<sup>49</sup> Bar represents an excellent option for attachment system that provides greater retention thanks to its splinting effect, it allows better force distribution, correct severe implants unparallel orientations, also the retentive components or clips are exchangeable and can be reactivated.<sup>26</sup> milled bar provides better oral hygiene care and improves Patients’ comfort due to increased retention and stability and avoid soft tissues trauma due to their limited tissue rest.<sup>50, 51</sup> **Fixed full-arch prostheses** are available in 2 types according to their method of attachment to the implants: cement retained or screw retained prostheses. Selecting the proper type is governed by several factors as retrievability, the framework passivity, space requirements, retention, simplicity of fabrication, occlusion, esthetics, , cost and complications.<sup>52</sup>

screw retained fixed prostheses have some great advantages as: Retrievability which is the ability to detach the prosthesis for replacement when needed with no harm of the restoration during removal.<sup>53</sup> Retention in screw-retained restorations is enhanced by the friction resistance between the internal threads of the implant and the fastening screw.<sup>54</sup> Immediate loading of edentulous jaws with screw-retained interim prostheses following the All-on-Four® surgical protocol has been found to provide the patient with function and esthetics at the same day of

surgery.<sup>55</sup>

**(Oral Health-Related Quality of Life) “OHRQoL”** describes different aspects of life being affected by the oral health. These include the ability to function (biting, chewing, and speaking), psychological status (self-esteem, satisfaction with appearance), social factors and pain or discomfort<sup>56</sup>

The OHIP-14 is one of the most widely used OHRQoL indicators internationally. was developed as a shorter version of the OHIP-49. It consists of 14 items that explore seven dimensions of impact: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap.<sup>57</sup>

### Materials and methods

Six patients wearing a mandibular implant supported overdenture and maxillary conventional denture, their age ranged from 55 to 65 years, were selected from outpatient clinic of the prosthodontic department, faculty of dentistry, Mansoura University.

**Inclusion criteria:** All patients wearing conventional complete denture. All patients were all healthy with no presence of any systemic diseases. There is sufficient bone quantity and quality in the anterior maxillary region. A minimum of 15 mm restorative space must be available.

**Exclusion criteria:** patients with bleeding disorders. Patients' having head and neck radiotherapy. Patients with metabolic disorders and hepatic disorders. Long term immunosuppressant and corticosteroid drug therapy. Patient with abnormal habits. Smoking patient. Patients having neuromuscular diseases. Patient with chronic problems in TMJ.

After the patients were informed about the line of treatment they all signed a written consent. The study was conducted according to the ethical principles stated and approved by the ethical committee of the faculty of dentistry.

Each patient received four implants according to the All-on-four® concept. The patients were classified into 2 groups: Group I received implant supported milled bar overdenture. Group II received implant supported fixed prosthesis.

### Presurgical protocol

CBCT was done to determine the proposed implant position. An acrylic resin radiographic template was duplicated from existing denture. Three gutta-percha markers were used to estimate the average thickness of the soft tissue covering the residual alveolar ridge and the thickness of the acrylic resin. Using (Dual scan protocol)<sup>58</sup>, the patients were double-scanned using CBCT and the two data sets were merged. Every patient's surgery was virtually planned then an individualized surgical template was made. Two implants were designed to be at canine area parallel to the vertical axis while the posterior ones were designed to be at the 2<sup>nd</sup> premolar area and were tilted distally forming a 30 degree angle from the vertical plane. Prototyping of surgical guide with openings for implants and anchor pins was constructed with metal tubes that guide implant drilling.

### Surgical Protocol

The stent was fixed in the correct position in patient's mouth by inserting the anchor pins into the underlying bone. The soft tissue was removed from the crest of the ridge

using a circular tissue punch. Depth drills of successive diameters that fits accurately the diameters of the hand sleeves were used to create the final depth of the implant osteotomy sites. Implants were taken from their vials and screwed into prepared osteotomy sites. Straight multiunit abutments were screwed in the anterior implants and 30-degree angled multiunit abutments were screwed into the posterior ones. Postoperative panoramic radiograph was done to verify the implant position.

### Prosthetic Protocol

Modification the old denture was done by removing the denture flanges and the palatal portion also four holes are hollowed in the denture base opposite to the multiunit abutments. Auto polymerized acrylic resin was used to pick up the temporary cylinder metal abutment caps to the modified denture. After 3 months of osseointegration period, a master cast was obtained by open tray impression technique. The provisional acrylic denture was unscrewed from the multiunit abutments. The long transfer copings were screwed to the multiunit abutments and splinted with orthodontic ligature wire then light cured composite resin. A stock tray was perforated opposite to each abutment to permit unscrewing of the transfer after impression setting. Light body rubber base silicon impression material was injected around the transfer copings and the tray was filled with a heavy body impression material then was inserted intraorally. The long transfer copings were unscrewed from the openings of the tray to be removed with the impression. Abutment analogues were screwed into the transfer coping. The Tissue replica was used around the abutment analogues then impression was poured to obtain master cast. The cast was scanned and the bridge was built virtually. A bridge pattern was milled using duralay®/autopolymerized resin. The passivity of the resin pattern (jig) was checked in the patient mouth. The bridge pattern was sprued, invested and casted with molten Co-Cr alloy. The fit of the metal bridge then was verified intraorally. Porcelain was built up and fused to the metal foundation.

Plastic cylinder caps were screwed to the multiunit abutment analogues. The cast was scanned. The bar dimensions were virtually determined. The cantilevered portion distal to the bar not exceeding 1.5 times the antero-posterior distance between the implants. Four Locator attachments were attached virtually to the top of the bar between implants. After the design was verified in software (Exocad), the bar resin pattern was 3D printed by rapid prototyping process. The bar resin pattern was tried intraorally to check the fitting. The bar pattern was spruced, invested and casted with molten Co-Cr alloy. Four metallic caps containing nylon rings for the locator attachments were snapped on the bar. The bar was returned to the master cast and the cast was scanned again. The bar housing was virtually designed covering the entire surface of the milled bar. The housing was milled from polyether ether ketone (PEEK) material. The teeth of the conventional denture was duplicated using a silicone mold which was repositioned over

the cast. The denture was flaked, acrylic resin was packed and the denture was finished and polished. The bar was

screwed to the abutment and the denture was seated. The PEEK housing with the attached denture were snapped on the bar and the occlusion was checked.



**Evaluation Oral Health-Related Quality of Life (OHRQoL assessment)**

OHIP-14 used for measuring OHRQoL. It was derived from the original extended version, OHIP-49, which was developed in 1994 by Slade & Spencer.<sup>59</sup> The OHIP-14 questionnaires were translated into Arabic by linguistic

professionals who worked in collaboration with the authors to prepare the final version.<sup>60</sup> A draft of the questionnaire

was prepared based on a literature review and expert opinions. An in-depth interview of four patients to identify any questions that required revision. All patients were asked to evaluate how often they felt and experienced an impact on oral health prior to and after prosthetic treatment with either implant overdenture or fixed implant prostheses by selecting one of the five responses for each item as a five-point Likert scale coded 0 (“never”), 1 (“hardly”), 2 (“occasionally”), 3 (“fairly often”), and 4 (“very often”).<sup>61</sup> Total OHIP-14 scores and subtotal scores for each dimension were calculated by adding together each item score; higher scores indicated worse OHRQoL.<sup>62</sup>

**Results**

In comparison of OHIP scores for all questions (items) for all groups, There was a significant difference in all questions of OHIP between groups except question 12 (difficulty in doing jobs). For all questions there was a significant difference between CD and FP and between CD and MB. However, no significant difference was noted between FP and MB for all items. In comparison of OHIP scores for all domains for all groups, there was a significant difference in all domains of OHIP between groups. For all questions there was a significant difference between CD and FP and between CD and MB. However, no significant difference was noted between FP and MB for all domains. In comparison of total OHIP scores for all groups, there was a significant difference in total OHIP between groups. For total OHIP there was a significant difference between CD and FP and between CD and MB. However, no significant difference was noted between FP and MB.

Table 1: Results of OHIP scores for questions for all groups

Domain	Item	CD		FP		MB		Kruskal Wallis test
		X	SD	X	SD	X	SD	
Functional limitation	OHIP1 Pronouncing sounds	2.33	.82	.50	.55	.67	.52	.005*
	OHIP2 Sense of taste	2.17	.75	.83	.41	.50	.55	.004*
Physical pain	OHIP3 Painful aching	3.00	.63	.67	.52	.67	.52	.002*
	OHIP4 Comfort on eating	2.83	.75	.17	.41	1.00	.63	.001*
Psychological discomfort	OHIP5 Self-consciousness	2.17	.75	.67	.52	.83	.75	.011*
	OHIP6 Feeling tense	1.83	.75	.50	.55	.67	.52	.012*
Physical disability	OHIP7 Unsatisfactory diet	2.33	.52	.50	.55	.83	.41	.001*
	OHIP8 Interrupting meals	2.50	.55	.50	.55	.83	.75	.003*
Psychological disability	OHIP9 Difficult to relax	1.17	.75	.33	.52	.50	.55	.007*
	OHIP10 Embarrassing	2.17	.75	.50	.55	.83	.41	.004*

<b>Social disability</b>	OHIP11	1.33	.52	.33	.52	.33	.52	.016*
	Irritability with people							
<b>Handicap</b>	OHIP12	.83	.75	.33	.52	.33	.52	.32
	Difficulty in jobs							
<b>Handicap</b>	OHIP13	2.67	.52	.33	.52	.67	.52	.002*
	Life in general							
<b>Handicap</b>	OHIP14	3.00	.89	.33	.52	.50	.55	.002*
	Inability to function							

Table 2: Results of total OHIP scores for all groups

<b>CD</b>		<b>FP</b>		<b>MB</b>	
<b>X</b>	<b>SD</b>	<b>X</b>	<b>SD</b>	<b>X</b>	<b>SD</b>
2.17	.92	.46	.50	.65	.55

### Discussion

OHIP-14 is one of the most commonly used instruments for measuring OHRQoL. It was chosen for this study over the original extended version, OHIP-49, which was developed in 1994<sup>59</sup> as it may be impractical sometimes in clinical application because of its length.<sup>62</sup> In Comparison of OHIP scores for all questions (items) for all groups There was a significant difference in all questions of OHIP between groups except question 12 (difficulty in doing jobs). This was in contrast with what was mentioned by<sup>57</sup> that significant differences were found between groups for all individual questionnaire items except for functional limitations item. This may be due to the difference in measuring tool in that study as the authors modify the OHIP-14 questionnaire and only used 9 items of them with other 2 items from a different questionnaire For all questions there was a significant difference between CD and FP and between CD and MB. However, no significant difference was noted between FP and MB for all items. This was agreed with De souza and his colleagues<sup>63</sup> who found no significant differences in any items between implant overdenture and fixed prosthesis. In Comparison of OHIP scores for all Domains for all groups, there was a significant difference in all domains of OHIP between groups. This finding was in line with<sup>62</sup> who stated that there was significant difference in the degree of improvements in OHRQoL for all 7 dimensions of OHIP in all three groups; fixed prosthesis, implant overdenture and complete denture. For all OHIP domains, there was a significant difference between CD and FP and between CD and MB. However, no significant difference was noted between FP and MB for all domains. This also was in agreement with what oh et al<sup>62</sup> who found no significant difference in all 7 domains of OHIP when comparing fixed implant prostheses with removable implant supported prostheses. This finding was in contrast to the study by Brennan et al.<sup>64</sup> who found that patients with fixed prostheses reported better OHRQoL than patients treated with removable implant overdentures with statistically significant difference in the psychological discomfort and psychological disability domains. This may be due to the effect of self preferences, patients who receive their preferred type of treatment may then consider some

specific treatment aspects more positively, even if the subjective measurements suggest otherwise. Comparison of OHIP scores for all groups There was a significant difference in total OHIP between groups. This was consistent with Oh et al.<sup>62</sup> who found that there were significant differences in the extent of improvement in the total OHIP-14 scores in all 3 groups; fixed prosthesis, implant overdenture and complete denture. For total OHIP there was a significant difference between CD and FP and between CD and MB. However, no significant difference was noted between FP and MB. This finding was in agreement with Heydecke<sup>65</sup> and Kimoto & Garrett<sup>66</sup> who found that greater satisfaction scores are reported in patients treated with implant-supported prostheses than those wearing conventional complete dentures, regardless of the type of implant supported prosthesis. This is in contrast with what was found by Allen et al.<sup>67</sup> that no significant difference was noted between treatment groups when comparing implant retained overdentures with conventional complete dentures. This contrast may be attributed to the short follow up period in that study at only 3 months after treatment that may be inadequate to judge its perception by the patient.

### Conclusion

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