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CHANGES IN ORAL-HEALTH IMPACT PROFILE (OHIP) OF IMPLANT SUPPORTED MANDIBULAR PARTIAL OVERDENTURES IN RELATION TO IMPLANT POSITION AND SUPPORT

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ABSTRACT

Background: Complete and partial tooth loss have been reported to have an adverse impact on patient appearance, phonetics, masticatory function, in addition to affecting the patient's quality of life and general health**.** Removable partial denture have been the most commonly used treatment option for the replacement of missing teeth, yet it offers disadvantages with regard to retention and stability. The use of dental implants especially in free end saddle cases using the overdenture approach, have improved both retention and stability. The clinical success of implant supported prosthesis have been documented but its impact on the quality of life needs to be investigated. The OHIP-49 was used to determine the impact of oral health conditions on aspects of daily function, social interactions in seven domains. The aim of this clinical trial is to evaluate the changes in the oral health related quality of life of partially edentulous patients in relation to implant position and implant support, by installing two implants in a free end saddle and using an implant supported removable partial overdenture.

Materials and Methods: 14 partially edentulous patients of Kennedy class II modification 1 were selected from the outpatient of the Prosthodontics clinic –Cairo University. All patients were ranging from age 45-65 years old. All patients in the study were seeking implant installation with their remaining dentition in good periodontal health to receive a metal framework removable partial denture after all necessary operative procedures carried out. Patients with any contra-indications to implant placement were excluded from the study. All patients have received two implants in the pre-molar and molar regions of free end saddle region. After three month from implant installation, a secondary stage surgery was carried out and the two implants have received a healing abutment. A metal framework partial denture was then fabricated and delivered to all patients, supported by two healing abutments which was considered to be the base line group. After three month from delivery of the metal partial denture all patients were asked to fill the OHIP-49 chart, and then the patients were randomly divided into two groups the first group received a ball attachment at the premolar region, and the second group received a ball attachment at the molar region. The OHIP-49 was translated into Arabic and then filled by both groups after a 3 month follow up.

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Results: There was no statistically significant difference of the total mean score of the OHIP-49 chart among the three groups of patients; base line group, first group and second group. The base line group have shown a non-significant decrease in the quality of life which was then improved by installation of a ball attachment in the first and second group, having the most non-significant improvement in the second group of patients. There was also a non-statistically significant difference of the seven subscales of the OHIP-49. The functional limitation, and physical pain of the OHIP-49 chart have shown the most improvement in the second group of patients when compared to the rest. Physical disability and Handicap subscales of the OHIP-49 chart were similar for the first and second groups, only the handicap encountering great improvement in the quality of life for base line group than the other two groups. While the Psychological discomfort, Physiological disability and Social disability were similar for all the three groups of patients.

Conclusion Implant supported removable partial denture with a ball attachment installed would improve the patient's quality of life when compared to an implant tooth-tissue removable partial denture supported by healing abutments. There was no statically significant difference in the quality of life total scores with installation of a ball abutment at either the pre-molar or molar region, but a non-significant improvement in the quality of life have been encountered at the ball attachment installed in the molar region.

INTRODUCTION

Total and partial tooth loss have been reported to have an adverse impact on patient appearance, phonetics, masticatory function[1], in addition to affecting the patients quality of life and general health[1,2]. Many prosthetic options have been put forward to solve the problem of partial edentulism as; fixed partial dentures, implant supported crowns, and removable partial dentures.

Removable partial denture have been the most commonly used treatment option for the replacement of missing teeth[3], because it offers several advantages such as replacing several missing teeth in one prosthesis, it is easier to clean when compared with fixed prosthesis, and it is a very cost-effective treatment option when compared to implant installation. On the other hand, removable partial dentures have offered limited retention and stability due to the tooth-tissue support mechanism of all partial dentures[4].Free end saddle cases such as Kennedy class I and II have further presented greater problems such as occlusal disharmony, and pain due to inflammation of the soft tissue under the connector or denture base due to their rotational movements during function[5,6]. All of such disadvantages of removable partial dentures such as lack of retention, stability and increased risk of biological complication have resulted in reducing patient satisfaction, and thus patient requiring fixed prosthesis as a treatment of choice. Despite that all dissatisfactions weren't related to esthetics, number of missing posterior teeth or number of modifications[7].

Most of the shortcomings of removable partial dentures have been overcome by installing dental implants and using the overdenture approach especially in free end saddle cases. Dental implants installed in free end saddle cases have improved retention and stability due to the implant direct action and their indirect action to the bone that have preserved the bone level around implants especially in the posterior edentulous area[3,8,9]. Several attachments have been used with implant supported/retained partial over denture, ball attachments have been indicated in cases where an implant supported fixed prosthesis can't be installed due to economic or anatomical reasons because in this case reduced bone height wouldn't represent any limitations as in

fixed implant supported prosthesis[6, 9,10]. In addition to that, the use of ball attachment is a simple technique that would improve retention, stability and chewing function[8,9].

Recently, assessment of health related quality of life and patient based outcome have been of great importance when considering oral implant therapy[11]. The majority of the clinical trials have focused on the evaluation of clinical, laboratory and radiological methods, all of this considered one component of the impact of the treatment but totally neglected the opinion and the attitude of the patient as a variable of treatment success.

The Oral Health Impact Factor is the most commonly used in the assessment of oral health related quality of life (OHRQoL). It was developed by ***Slade and Spencer in 1994***[12] and was validated in cross sectional population studies in North America, Canada and Australia[13-16]. It originally consists of 49 items organized into 7 subscales; Functional limitation, Physical discomfort, Physical disability, Social disability, and Handicap. Responses are rated on a scale of "0" for never and "4"for very often. The total score of OHIP is either by adding all of the ratings of the questionnaire items (additive count) or by categorical scoring simple count method. Higher OHIP indicates poor oral health status.

Several authors have reported the outcomes of implant supported partial dentures, but very few studies have evaluated the effect of implant supported partial dentures on the oral health related quality of life (OHRQoL)[17]. The aim of this clinical trial is to evaluate the changes in the oral health related quality of life of partially edentulous patients in relation to implant position and implant support, by installing two implants in a free end saddle and using an implant supported removable partial overdenture.

MATERIALS AND METHODS

14 partially edentulous patients of Kennedy class II modification 1 were selected from the outpatient of the Prosthodontic clinic –Cairo University. All patients were ranging from age 45-65 years old. All restorative procedure to the remaining teeth necessary was carried out; all teeth that would require crowns, in/on-lays were fabricated. Teeth with old amalgam filling were included. All periodontally compromised teeth were extracted only with exception if the last abutment teeth on the modification area it was left un-extracted, it was designed to receive a rest so as not to convert the case to a class I Kennedy. All included patients should have enough inter-arch distance to receive a metal framework partial denture with acrylic teeth and a stable opposing occlusion. Patients with any contra-indications for implant installation were excluded from the study, also patients who were not able to follow instructions during follow up periods as well as those not able to sign an informed consent were excluded from the study.

In this clinical trial all patients included have received acrylic temporary partial denture following the conventional steps before implant installation. The temporary acrylic partial denture was used to fabricate a surgical stent that will guide for the proper implant installation. A cone beam CT (CBCT) was made for all patients using an acrylic stent with radio-opaque markers at the site of implant installation. Two implants were to be installed in the premolar area and in the molar area. The CBCT was used to determine the proper width and height of the implants to be used, which was variable. All implants used in this clinical trial were Implant Direct*.

All patients were prescribed to receive 2mg of amoxicillin 2 hours before surgery. Local anesthesia was administered in the site of implant installation.

* Screw plant Implants, Implant direct TM LLC Spectra- system Dental implants , 27030 Malibu Hills , USA

Implant installation was carried out following the manufacturer instructions. Two implants were installed one in the first premolar region and the other in the molar region area. A conventional loading protocol was followed, and the temporary partial denture was modified at the day of implant installation to be used comfortably by the patient during the 3 month healing period. A secondary stage surgery was carried out for all patients and a healing abutment was screwed to the two implants. After 2 weeks from healing abutment placement, all included patients will receive a new partial denture metal framework.

Metal framework partial denture fabrication

A primary impression was carried out with the healing abutments in place. A special tray was then fabricated on the primary cast to accommodate an open tray transfer coping. The primary cast had the metal framework design drawn on it, and the cast was surveyed, outlining all of the necessary mouth preparation to be carried out. In cases that would require a surveyed crown, in/on lays, the design of the metal framework was incorporated in the wax pattern of the required restorations. The healing abutments were unscrewed and then an open tray transfer copings were screwed to the implants, and after all necessary mouth preparations were carried out, a medium rubber base impression* was used for the secondary impression. An implant analogue was screwed to each transfer coping and a tissue mimic was used to simulate the gingival tissues. The healing abutment was then screwed again to each implant inside the patient's mouth.

The secondary impression was poured into an extra hard stone cast, and the two transfer coping were unscrewed. The two ball attachments were then screwed to each implant. The nylon cap and the metal housing was placed over each ball attachment. The conventional steps for the metal framework fabrication was carried out. After the metal framework was casted and then finished and polished, it was tried in the patient mouth, for proper and passive seating. A wax bite was used to record a jaw relation record, then try in and finally delivery of the finished and polished partial denture.

All patients in this clinical trial received the finished and polished partial denture with the two healing abutments screwed to the two implants placed at the premolar and molar region. The fitting surface of the partial denture opposing the healing abutments were modified to ensure proper seating of the partial denture without causing any pressure. The OHIP-49 chart was translated into Arabic and then filled by all patients after 3 month from delivery of the finished and polished partial denture (**Fig 1**).

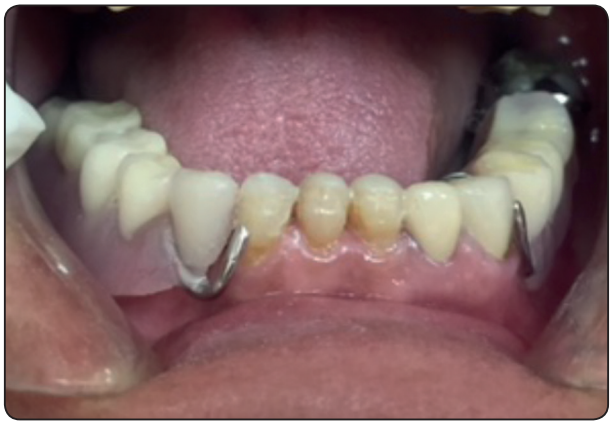

Fig. (1) A new partial denture metal framework received by all patients in the study.

After three month from delivery of the partial denture with the two healing abutments screwed to the two installed implants, the patients were then randomly divided into two groups; the first group of patients will receive a ball attachment being screwed to implant installed in the premolar region and a healing abutment on the molar implant **(Fig 2)**, while the second group of patients will receive a ball attachment at the implant installed

* ImpregumTM ,PentaTM , 3M ESPE, Poly ether impression material, Seefeld, Germany.

in the molar region and a healing abutment at the premolar implant. Randomization was carried out using sealed envelopes.

The ball attachment will be screwed on the implant either on the premolar area or molar area with the nylon cap and a metal housing will be picked up with in the fitting surface of the denture.

The OHIP-49 Arabic version was then filled by patients in both groups 3 month after pick up.

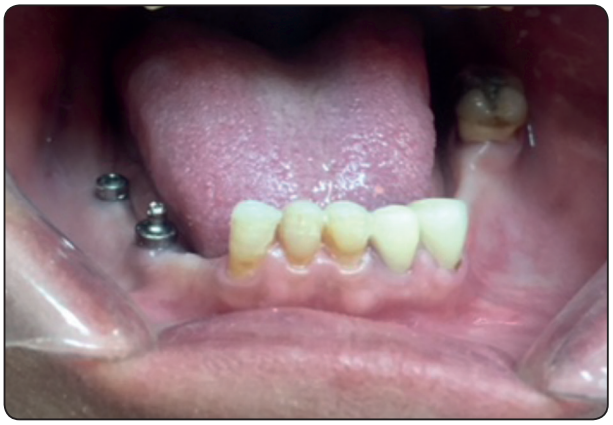

Fig. (2) Showing the patient after randomization, the first group of patients

Pick up of the ball attachment to the fitting surface of the partial denture

During the fabrication of the metal framework, the space of the metal housing and nylon cap was preserved and the shape of the metal housing was duplicated within the fitting surface of the metal framework partial denture.

The ball attachment with the nylon cap and metal housing was placed inside the patient's mouth, to the assigned implant, and the healing collar screwed to the neighboring implant. A red die was painted over the metal housing and the surface of the healing abutment. The partial denture was then seated inside the patient's mouth and the patient was asked to close in centric relation. The fitting surface of the partial denture was examined for marks of the red die that would be due to pressure caused by the metal housing and healing abutments. The red marks will be removed using an acrylic bur, the whole process will be repeated until no red marks was seen on the fitting surface of the partial denture.

After modification of the fitting surface of the partial denture, and ensuring that no pressure was caused by seating of the partial denture over the metal housing and the healing abutment, a soft mix of self-cure acrylic resin* was placed over the metal housing of the ball attachment, and the patient was asked to close in centric relation. The metal housing with the nylon cap was then picked up in the fitting surface of the partial denture (**Fig 3 & 4**). Occlusion was then checked and all pre-mature contacts were selectively grinded.

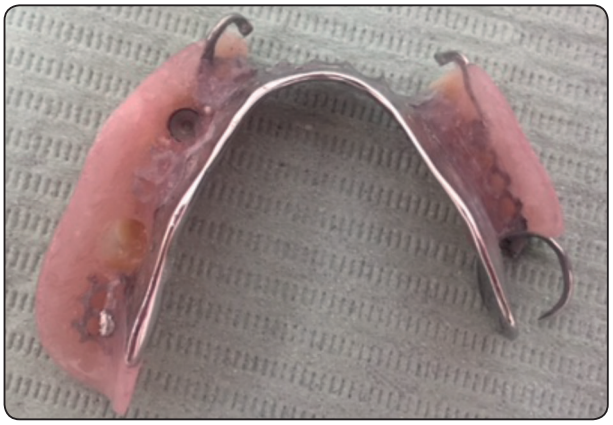

Fig. (3) Showing the partial denture fitting surface after pick up for the first group of patients.

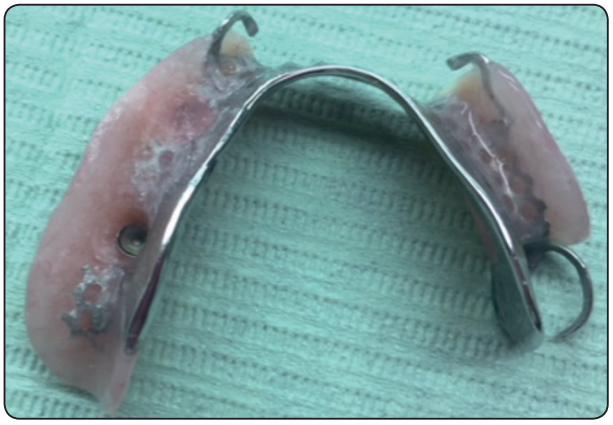

Fig. (4) Pick up for second group of patients.

* Acrostone, cold cure Egypt.

A comparison of the OHIP-49 scores were then recorded and statistically analyzed after a 3 month follow up for both groups of patients.

RESULTS

The mean and standard deviation values were calculated for each group. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. Data showed non-parametric (not-normal) distribution. Kruskal-Wallis test was used to compare between more than two groups in non-related samples. While, Mann Whitney test was used to compare between two groups in non-related samples. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

Each of the subscales were then compared for the three groups**; the base line group** with only two healing abutments screwed to the implants, and **then the first group** which has a ball attachment screwed to the implant at the premolar and a healing abutment at the molar region, and **the second group** which has the ball attachment screwed to the implant at the molar region and a healing abutment at the premolar region. The seven subscales are as follows;

1- Functional

2- Physical pain

3- Pyscoligical discomfort

4- Physical disability

5- Psychological disability

6- Social disability

7- Handicap

As well as the total score (Cumulative) count of the OHIP for the base line group, first group and second group after a 3 month follow up.

All scores in OHIP-49 chart were; 0= never, 1= hardly, 2= occasionally, 3=fairly often and 4= very often. This continuous variable has a possible range from zero to 196 with high scores denoting worse oral health quality of life, while zero indicating an improvement in quality of life.

Functional limitation

Functional limitation
1- Have you had difficulty chewing any foods because of problems with your teeth, mouth or dentures?
2- Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?
3- Have you noticed a tooth which doesn't look right?
4- Have you felt that your appearance has been affected because of problems with your teeth, mouth or dentures?
5- Have you felt that your breath has been stale because of problems with your teeth, mouth or dentures?
6- Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?
7- Have you had food catching in your teeth or dentures?
8- Have you felt that your digestion has worsened because of problems with your teeth, mouth or dentures?
9- Have you felt that your dentures have not been fitting properly?

Fig. (5): The questions of the functional limitation subscale of the OHIP-49[12]

When comparing the total mean scores of the 9 questions of the functional limitation as shown in Figure 5 for the three assigned groups; the base line group, the first group and the second group, it was found that there is no statistically significant difference in the total mean score between the three groups after a 3 month follow up period (P=0.185). The base line value have recorded the highest mean score of 2.11±1.05, followed by the first group 1.78 ± 0.83, and the lowest mean score was achieved by the second group 1.44 ± 0.73 which indicates an improvement in the functional limitation (**Table 1 & Fig 11**)

Physical pain

Physical pain
10- Have you had painful aching in your mouth?
11- Have you had a sore jaw?
12- Have you had headaches because of problems with your teeth, mouth or dentures?
13- Have you had sensitive teeth, for example, due to hot or cold foods or drinks?
14- Have you had toothache?
15- Have you had painful gums?
16- Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?
17- Have you had sore spots in your mouth?
18- Have you had uncomfortable dentures?

Fig. (6): The questions of the Physical pain subscale of the OHIP-49[12]

The total mean score of the 8 questions of the physical pain (**Fig 6**) have recorded the highest mean score for the base line group 1.22 ± 1.09, followed by the first group of patients 1.11 ± 0.93 and the lowest mean score for the second group of patients 0.78 ± 0.67, with no statistically significant differences between the three groups (P=0.599) (**Table 1& Fig 11**).

TABLE (1): The mean, standard deviation (SD) values for the functional limitation and the Physical pain of the OHIP-49.

Variables	Functional		Physical pain	
	Mean	SD	Mean	SD
Base line	2.11	1.05	1.22	1.09
Group1	1.78	0.83	1.11	0.93
Group2	1.44	0.73	0.78	0.67
P-value	0.185ns		0.599ns	

Superscripts with different small letters indicate statistically significance difference within the same column. *; significant (p≤ 0.05) ns; non-significant (p>0.05)

Psychological discomfort

Psychological discomfort
19- Have you been worried by dental problems?
20- Have you been self-conscious because of your teeth, mouth or dentures?
21- Have dental problems made you miserable?
22- Have you felt uncomfortable about the appearance of your teeth, mouth or dentures?
23- Have you felt tense because of problems with your teeth, mouth or dentures?

Fig. (7): The questions of the psychological discomfort subscale of the OHIP-49[12]

There was no statistically significant difference between the total mean score for the Psychological discomfort subscale of the OHIP-49 (P=1) , and a similar total mean score of 1.20 ± 0.45 was recorded for all three groups after a 3 month follow up (**Table 2 & Fig 11**).

Physical disability

Physical disability
24-Has your speech been unclear because of problems with your teeth, mouth or dentures?
25-Have people misunderstood some of your words because of problems with your teeth, mouth or dentures?
26- Have you felt that there has been less flavor in your food because of problems with your teeth, mouth or dentures?
27-Have you been unable to brush your teeth properly because of problems with your teeth, mouth or dentures?
28-Have you had to avoid eating some foods because of problems with your teeth, mouth or dentures?
29- Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?
30-Have you been unable to eat with your dentures because of problems with them?
31- Have you avoided smiling because of problems with your teeth, mouth or dentures?
32-Have you had to interrupt meals because of problems with your teeth, mouth or dentures?

Fig. (8): The questions of the Physical disability subscale of the OHIP-49[12]

Figure 8 displays the 9 questions of the physical disability subscale of the OHIP-49, when comparing the total mean score of the 9 questions for the three groups it was found that there was no statistically significant difference between the three groups (P=0.238), with the highest total mean score recorded for the base line group 1.33 ± 0.71, and the total mean scores for the first and second group were similar recording a value of 0.89 ± 0.60 (**Table 2 & Fig 11**).

TABLE (2): The mean, standard deviation (SD) values for Psychological discomfort and physical ability of the OHIP-49.

Variables	Psychological discomfort		Physical disability	
	Mean	SD	Mean	SD
Base line	1.20	0.45	1.33	0.71
Group1	1.20	0.45	0.89	0.60
Group2	1.20	0.45	0.89	0.60
P-value	1ns		0.238ns	

Superscripts with different small letters indicate statistically significance difference within the same column. *; significant (p≤ 0.05) ns; non-significant (p>0.05).

Psychological disability

Social disability

5-Psychological disability
33- Has your sleep been interrupted because of problems with your teeth, mouth or dentures?
34- Have you been upset because of problems with your teeth, mouth or dentures?
35-Have you found it difficult to relax because of problems with your teeth, mouth or dentures?
36- Have you felt depressed because of problems with your teeth, mouth or dentures?
37-Has your concentration been affected because of problems with your teeth, mouth or dentures?
38- Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?

6-Social disability
39-Have you avoided going out because of problems with your teeth, mouth or dentures?
40- Have you been less tolerant of your spouse or family because of problems with your teeth, mouth or dentures?
41- Have you had trouble getting on with other people because of problems with your teeth, mouth or dentures?
42-Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?
43- Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?

Fig. (9): The questions of the Psychological disability and Social disability subscales of the OHIP-49[12]

For both subscales of the Psychological disability and social disability, there was no statistically significant difference of total mean score between the three groups after a 3 month follow up (P=1), with similar total mean score for all three groups. The Psychological discomfort total mean score 0.83 ± 0.41 for all three groups, and the social disability have shown a total mean score of 0.00 ± 0.00 for all three groups after a 3 month follow up (**Table 3 & Fig 11**).

TABLE (3): The mean, standard deviation (SD) values for Psychological disability and social disability of the OHIP-49.

Variables	Psychological disability		Social disability	
	Mean	SD	Mean	SD
Base line	0.83	0.41	0.00	0.00
Group1	0.83	0.41	0.00	0.00
Group2	0.83	0.41	0.00	0.00
P-value	1ns		1ns	

Superscripts with different small letters indicate statistically significance difference within the same column. *; significant (p≤ 0.05) ns; non-significant (p>0.05).

Handicap

Handicap
44- Have you felt that your general health has worsened because of problems with your teeth, mouth or dentures?
45- Have you suffered any financial loss because of problems with your teeth, mouth or dentures?
46- Have you been unable to enjoy other people's company as much because of problems with your teeth, mouth or Dentures?
47- Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?
48- Have you been totally unable to function because of problems with your teeth, mouth or dentures?
49- Have you been unable to work to your full capacity because of problems with your teeth, mouth or dentures?

Fig. (10): The questions of the Handicap subscales of the OHIP-49[12].

There was no statistically significant differences between the total mean scores of the 6 questions of the handicap subscale of the OHIP-49 (P=0.584), the base line group has recorded a total mean score of 0.00 ± 0.00, while both first and second group have scored a total mean score of 0.20 ± 0.45 after a 3 month follow up (**Table 4 & Fig 11**).

Cumulative (Total) quality of life score

When comparing the total cumulative score of the 7 subscales of the OHIP-49 questionnaire, for the three groups in this clinical trial, it was found that there was no statistically significant difference in the total mean score (P=0.521) between the base line, the first group and the second group of patients. The base line have recorded the highest total mean score 1.08 ± 0.99, followed by the first group 0.94 ± 0.83, and the second group recording 0.82 ± 0.70, which shows that the second group of patients have recorded an improvement in the quality of life (**Table 5 & Fig 11**).

TABLE (4): The mean, standard deviation (SD) values for Handicap of the OHIP-49.

Variables	Handicap	
	Mean	SD
Base line	0.00	0.00
Group1	0.20	0.45
Group2	0.20	0.45
P-value	0.584ns	

Superscripts with different small letters indicate statistically significance difference within the same column. *; significant (p≤ 0.05) ns; non-significant (p>0.05).

TABLE (5): The mean, standard deviation (SD) values for cumulative (total) score of OHIP-49.

Variables	Quality of life	
	Mean	SD
Base line	1.08	0.99
Group1	0.94	0.83
Group2	0.82	0.70
P-value	0.521ns	

Superscripts with different small letters indicate statistically significance difference within the same column. *; significant (p≤ 0.05) ns; non-significant (p>0.05).

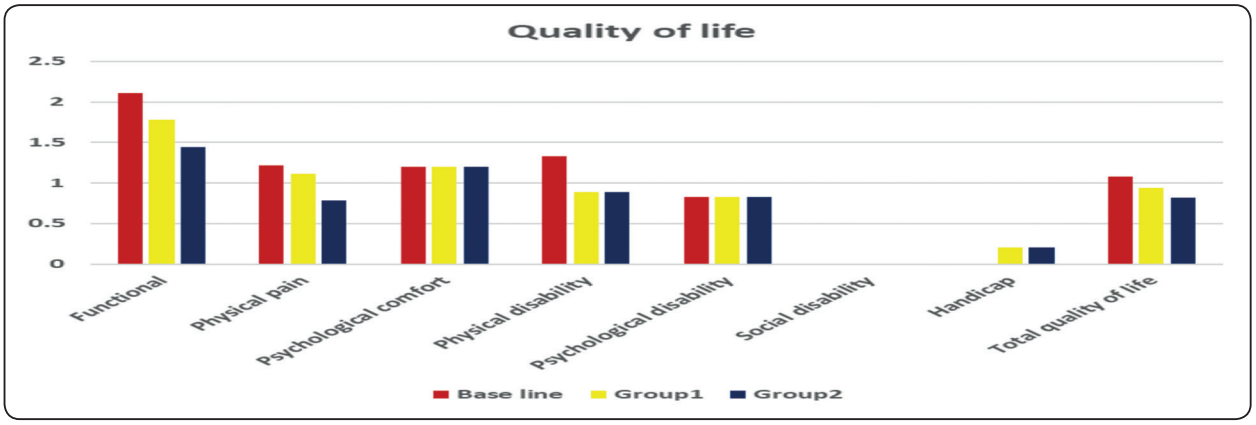

Fig. (11): Bar chart expressing the subscales and cumulative (total) scores of the OHIP-49 for the different groups after 3 month follow up.

DISCUSSION

Clinical success of implant supported prosthesis have been documented[18], but still the impact of such prosthesis on the quality of life needs to be further investigated. The OHIP-49 was used in this study to determine the impact of oral health conditions on aspects of daily function, social interactions in seven domains[12].

In the present clinical trail the difference between the base line group, the first and second group was mainly a difference in the denture support. In the base line group which was considered to be the control group, the two healing abutments only provided support as previously reported by a study of ***Brudvick 1999***[19], so the partial denture in this case had a tooth-mucosa support. While in both the first and second group a ball abutment was installed which have shifted the partial denture support in both groups to an implant supported prosthesis. It could be shown from the results of this study that there was no statistically significant difference in the total mean score of the quality of life between the three groups, but when comparing the scores between the base line and both the first and second group, it was reported that both the first and second groups have shown an improvement in the quality of life when compared to the base line group. An explanation for this result would be due to the shift in the partial denture support from tooth mucosa (base line group) to implant supported (first and second group) which have resulted in changes in the settling of the denture base during the adaptation phase of the partial denture. The presence of the healing abutments will only support vertical loading, while the presence of ball abutment will resist inward and outward forces. The ball abutment in the first and second group have eliminated the leverage of the implant-supported partial denture, and thus have resulted in an improvement in partial denture stability, and also less pressure on the resilient mucosa which consequently have improved chewing, appearance, increased patient confidence, and decreased any impingement to the underlying mucosa thus decreasing patient complaints, and torque to the principal abutments. That was interpreted when comparing the scores of the functional limitation , physical pain and physical disability of the OHIP-49 which have reported that the base line recorded the highest total mean score (poor quality of life) in comparison to the both the first and second group, showing an improvement in quality of life. This would come in agreement to the results of **Wismeijer et al 2013**[20] that have concluded that a transition from an implant tooth mucosa supported partial denture with healing abutments to the implant assisted removable partial denture by incorporating a ball attachment have

improved patient responses to stability , chewing , and appearance thus improving the overall patient satisfaction.

When comparing between the first and second group of the removable partial implant supported partial denture, there was a difference in the position of the ball abutment. In the first group the ball abutment was installed in the premolar region, while in the second group the ball abutment was installed in the molar region. It was found that there was no statistically significant difference between the total mean quality of life scores of the OHIP-49 chart between the first and second group, but the second group of patients have reported a slightly non-significant improvement in the quality of life than the first group. Studies[21-23] have reported that installing dental implant more posterior would reduce the pressure exerted to the alveolar ridge and to the underlying periosteum than anterior. Installing implants in the molar area would result in minimum displacement of the underlying mucosa tissue under load[24-26]. This would be the reason that the second group of patients have shown a non-significant better quality of life total mean score for the functional and physical pain of OHIP-49 than the first group. On the other hand ***Jensen et al 2017*** [27] have concluded that most clinical parameters concerning both implant and teeth have shown no difference when implants are loaded at the molar or premolar area in a free end saddle cases for partially edentulous patients. That was greatly evident in our clinical study by having similar total mean score for the Physical disability and Handicap subscales of the OHIP-49 chart for both the first and second group of patients.

When considering the different subscales of the OHIP-49 chart, there was still no significant difference between the three groups, but the Psychological discomfort, Physiological disability and Social disability have recorded a similar mean total score for all of the three groups. That is because the removable partial denture was supported by two implants, despite the difference in support between the three groups that would have an effect the functional activity of the patient. But with regards to the patient psychology and social ability, the partial denture supported by two implants have improved patient confidence making him more relaxed, with fewer complaints and reduced denture movement than if otherwise compared with a conventional removable partial denture without any implant support. So that was the reason that there was no difference between the three groups of patients when evaluating the physiological, psychological and social impact of the implant retained removable partial denture among the patients.

The handicap subscale was the only subscale of the OHIP-49 that had the baseline group to have a non- significant better total mean quality of life score than the first and second group. As the handicap subscale is concerned with financial cost, enjoying other company , and general health, it is clear that patient transition from the temporary partial denture (before implant installation) to the implant tooth- mucosa supported partial denture (base line group) have shown a better improvement in the quality of life which had a greater impact than when comparing the patient shift from the base line group to that of the first and second group. That would explain why the base line value of the handicap subscale was lower when compared to the first and second group.

The present study have evaluated the same patient before and after the conversion of implant tooth-mucosa supported removable partial denture to the implant –supported removable partial denture with only difference in the position of ball abutment installed, thus having a homogenous sample with a population having the same clinical characteristics with the same number of teeth and similar type of prosthesis which will increase the power of comparison between the treatments. The adaptation

period chosen in this study was three month which was considered to be satisfactory, as masticatory function of implant supported partial denture was shown to improve after three month[27].

A conclusion to be drawn from this clinical study that there was no statistically significant difference between the total mean scores of the OHIP-49 chart among the three groups in this study. Implant supported removable partial denture with a ball attachment installed would improve the patients quality of life when compared to an implant tooth-tissue removable partial denture supported by healing abutments. There was no statically significant difference in the quality of life total scores with installation of a ball abutment at either the pre-molar or molar region, but a non-significant improvement in the quality of life have been encountered at the ball attachment installed in the molar region.

REFERENCES

1- Miura H, Kariyasu M, Yamasaki K, Arai Y, Sumi Y. Relationship between general health status and the change in chewing ability: a longitudinal study of the frail elderly in Japan over a 3-year period. Gerodontology 2005; 22:200–205.

2- Brennan DS, Singh KA. Dietary, self-reported oral health and sociodemographic predictors of general health status among older adults. J Nutr Heal Aging 2012; 16:437–441.

3- Gates WD, Cooper LF, Sanders AE, Reside GJ, De Kok IJ. The effect of implant-supported removable partial dentures on oral health quality of life. Clin Oral Implants Res 2012; 00:1–7.

4- De Freitas RFCP, de Carvalho Dias K, da Fonte Porto Carreiro A, Barbosa GA, Ferreira MA. Mandibular implant-supported removable partial denture with distal extension: a systematic review. J Oral Rehabil2012; 39:791–798.

5- Ben-Ur Z, Aviv I, Maharshak B. Factors affecting displacement of free end saddle removable partial dentures. Quintessence Int 1991; 22:23-27.

6- Sato M, Suzuki Y, Kurihara D, Shimpo H, Ohkubo C. Effect of implant support on mandibular distal extension removable partial dentures: relationship between denture supporting area and stress distribution. J Prosthodont Res 2013; 57:109–112.

7- Zlataric, D.K., Celebic, A., Valentić-Peruzović, M., Celić, R., Filipović-Zore, I. & Baucić, M. The satisfaction with the removable partial denture therapy in the Croatian adult population. Collegium Antropologicum 2000;24: 485–494.

8- Ohkubo C, Kobayashi M, Suzuki Y, Hosoi T. Effect of implant support on distal-extension removable partial dentures: in vivo assessment. Int J Oral Maxillofac Implants 2008; 23:1095–1101.

9- Rodrigues RCS, Faria ACL, Macedo AP, de Mattos MDGC, Ribeiro RF. Retention and stress distribution in distal extension removable partial dentures with and without implant association. J Prosthodont Res 2013; 57:24–29.

10- Cordaro L, Torsello F, Roccuzzo M. Implant loading protocols for the partially edentulous posterior mandible. Int J Oral Maxillofac Implants 2009; 24:158–168.

11- McGrath C, Lam O, Lang N. An evidence-based review of patient-reported outcome measures in dental implant research among dentate subjects. J Clin Periodontol. 2012; 39(Suppl 12):193-201.

12- Slade, G. D. and A. J. Spencer. Development and evaluation of the Oral Health Impact Profile. Community Dental Health 1994; 11(1): 3–11.

13- Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol. 1997; 25(4):284-290.

14- McGrath C, Comfort MB, Lo EC, Luo Y. Patient centered outcome measures in oral surgery: validity and sensitivity. Br J Oral Maxillofac Surg. 2003; 41 (1):43-47.

15- Locker D, Jokovic A, Clarke M. Assessing the responsiveness of measures of oral health-related quality of life. Community Dent Oral Epidemiol. 2004 Feb; 32(1):10-8.

16- Awad M, Al-Shamrany M, Locker D, Allen F, Feine J. Effect of reducing the number of items of the Oral Health Impact Profile on responsiveness, validity and reliability in edentulous populations. Community Dent Oral Epidemiol. 2008; 36(1):12-20.

17- Swelem AA, Gurevich KG, Fabrikant EG, Hassan MH, Aqou S. Oral health-related quality of life in partially edentulous patient's treated with removable, fixed, fixed-removable, and implant-supported prostheses. Int J Prosthodont. 2014; 27:338-347.

18- Zarb GA, Schmitt A. The longitudinal clinical effectiveness of osseointegrated dental implants. The Toronto Study. Part II: The prosthetic results. J Prosthet Dent 1990; 64:53-61.

19- Brudvick, J.S. Implants and removable partial dentures. In: Brudvick, J.S., ed. Advanced Removable Partial Dentures 1999, 153–160. Chicago: Illinois.

20- Wismeijer D, Tawse-Smith A, Payne AGT. Multicentre prospective evaluation of implant–assisted mandibular bilateral distal extension removable partial dentures: patient satisfaction. Clin. Oral Impl. Res. 24, 2013, 20–27doi: 10.1111/j.1600-0501.2011.02367.

21- Memari Y, Geramy A., Fayaz A., Revani Habib Abadi S., Mansouri Y. Influence of implant position on stress distribution in implant assisted distal extension removable partial dentures; 3D finite element analysis. J Dent (Tehran) 2014; 11:523-530.

22- Mastudate Y., Yoda N., Nanba M., Ogawa T., Sasaki K. Load distribution on abutment tooth, implant and residual ridge with distal extension implant –supported removable partial denture. J Prosthodont Res.2016; 60(4):282-288.

23- Oh WS, oh TJ, Park JM. Impact of implant support on mandibular free-end base removable partial denture: Theoretical study. Clin Oral Implant Res 2016; 27:e87-e90.

24- Cunha LD, Pellizzer EP., Verri FR., Pereira JA. Evaluation of the influence of location of osseointegrated implants associated with mandibular removable partial dentures.Implant Dent 2008;17:278-287.

25- Ohkubo C., Kurihara D., Shimpo H., Suzuki Y., Kokubo Y., Hosoi T. Effect of implant support on distal extension removable partial denture : invitro assessment. J Oral Rehabil. 2007;34:52-56.

26- De Freitas Santos CM., Pellizzer EP., Verri FR., de Moraes SL., Falcon –Antenucci RM. Influence of implant inclination associated with mandibular class I removable partial denture. J Craniofac. Surgery 2011;22:663-668.

27- Jensen C., Speksnijder CM., Raghoebar GM., Kerdijk W., Meijer HJA, Cune MS. Implant supported mandibular removable partial dentures: Functional, clinical and radiographical parameters in relation to implant position. Clin Implant Dent Relat Res. 2017;19:423-439.