Clinical and Electromyography Evaluation of the Effect of Lined Over Denture for Patient with Hypodontia

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Abstract: Congenital absence of teeth affects 2-6 per cent of the population. Ectodermal dysplasia(ED) is accompanied with multiple tooth abnormality, and absence of one or more teeth from the dentition. The prosthodontic management depends on the degree of anodontia/hypodontia. In complete anodontia, the treatment would comprise of complete dentures, either conventional or implant supported ones. In patients with partial anodontia, removable/fixed partial dentures and over dentures may be considered. The aim of the present study was to evaluate and compare between conventional and lined over denture with soft liner "Bitem" clinically and Eelectomyographyically on patients with Hypodontia. Fourteen patients suffering from moderate to severe degree of Hypodontia and aged from 12- 18 years were selected. The patients were divided into two groups, seven patients in each, the group A, received conventional overdenture and the group B, received lined overdenture. The clinical (pocket depth and gingival index) and Eelectomyographyical evaluation was carried at one week, three months& six months. The result of this study as regards pocket depth and gingival index showed that there was no significant difference in groups A & B during the follow up period at one week, three months& six months .Also in comparing between the two groups there was no significant difference between them during the follow up period. Electomyographyically, the masseter muscle activity decrease at follow up period for groups A & B but the decrease was insignificant in group A & significant in group B. There was not statistically significant difference was found between the two groups in all intervals. As regards chewing time in seconds, there was significant difference in groups A & B at follow up period, in comparing between the two groups the difference was insignificant at baseline & significant at six months. Finally, the result of chewing strokes showed that, there was significant difference in groups A& B at follow up period and also between groups at six months, but there was insignificant difference between the two groups at baseline follow up period**. [**Saeed M Abdullah and Faten A. Abu Taleb **Clinical and Electromyography Evaluation of the Effect of Lined Over Denture for Patient with Hypodontia]** *J Am Sci*2013;9(5):22-35]. (ISSN: 1545-1003). http://www.americanscience.org. **4**

Key wards: Hypodontia –Overdenture- soft liners -electromyography

1. Introduction

(ED) is a group of hereditary diseases with abnormal development of two or more structures of ectodermal origin[1]. ED can be hypohidrotic or hidrotic depending on the sweat gland function[2].

Oral findings include total or partial anodontia affecting both the primary and the permanent dentitions. The teeth are usually conical or peg shaped. Alveolar ridges are underdeveloped resulting in reduced vertical dimension, thereby giving a senile facial appearance along with protuberant dry lips[1,3].The treatment for a patient with ectodermal dysplasia varies and generally depends on child's age, dental agenesis, degree of malformation of teeth, the growth and development of the stomatognathic system of the patient and patient's motivation[4.]

The aim of the treatment is to provide adequate function, maintain the vertical dimension and restore acceptable aesthetic appearance at all developmental stages without jeopardizing the success of the final result[7]. The proper management of patients with hypodontia requires an interdisciplinary team approach. At the least, this should include a pediatric dentist, a prosthodontist, an orthodontist and an oro maxillofacial surgeon[6,7]. Abadi *et al.*, (1982)[8] Winstanley (1984)[9] reported that a removable prosthetic appliance is indicated in hypodontia to restore masticatory efficiency, prevent or correct harmful habits or speech abnormalities and establish esthetics.

Implants become a basis for permanent anchoring[10,11] and considered as an alternative treatment at young age[12,13]. Nevertheless Wagenberg and Spitzer (1998)[14] reported that treatment of young people with implants requires advanced planning and coordination of many different specialties within dentistry. Timing and sequence of therapy will often decide the success or failure of treatment.

Jepson *et al.*, 2003[15] & Shigli *et al.*, 2005[16] stated that a conventional over denture was the treatment of choice for the patient with hypodont ia at young age, because the objective was the preservation of the remaining dentition to restore function and esthetics and to allow certain modification to meet the needs of the developing stomatognathic system.

Wright, (1986)[17] reported that the rationale behind success of relined denture bases is that they enable energy to be absorbed as they replace the missing oral mucosa, thereby reducing the load on the supporting tissues. Consequently, load is evenly distributed over the whole denture bearing area by preventing localized areas of stress concentration. Soft liners have been a valuable assist for dentists because of their visco-elastic properties. The material must compress and disturb the stresses on the denture bearing tissues when a load is applied and recover

when it is released, and must maintain the desired resiliency over time[18, 19].

El-Charkawi *et al.* (1988)[20] evaluated the effect of the resilient liner for distal extension partial denture on abutment movement. They concluded that the resilient layer for distal extension removable partial denture decreased distal abutment movements and reduced the strain delivered to the supporting alveolar structure surrounding the abutment tooth and the resilient layer distal extension reduced the load transmitted to the alveolar ridge under distal extension. So that the use of a resilient layer minimizes ridge resorption.

El- Helbawy (2006)[21] investigated some clinical and mechanical properties of (BITEM) for one year as a new thermo-elastic permanent soft liner and concluded that the material showed a minimal tissue irritation. The plaque accumulation was minimal and nearly stable during the test periods. The author recommended the use of BITEM acrylic soft reline material as a long term soft reline material.

Electromyography is defined as the graphic recording of the electrical potential of muscle[22]. Bajoury and Bassiouny (2003)[23] evaluated how the soft lining of both maxillary and mandibular complete dentures influences the activity of the masseter and temporalis muscles by using electromyography to determine changes in muscle activity. The findings indicated an increase in muscle activity after insertion of dentures and prior to application of soft lining material. These activities decreased gradually throughout the 12-weeks evaluation period following the application of soft liner.

Materials and Methods

Fourteen patients suffering from moderate to severe degree of Hypodontia were selected from the Prosthodontic Outpatients Clinic; Faculty of Dentistry, Tanta University. Aged from 12- 18 years, they had no previous denture experience &free from that might affect muscle activity like neuromuscular disorders. All the patients should have enough intermaxillary space. The patients were with no abnormal habits such as bruxism, clenching and tongue thrust. They had relatively good oral hygiene and were ready to cooperate through the study. (Fig. 1).Medical and dental history of the patients with a full mouth examination (visual & digital examination) & panoramic radiographic examination were done at the first visit to fulfill the proper evaluation of the existing and impacted teeth. Presence of any bony lesions of both jaws, presence of any hidden caries teeth or remaining roots, revelation if the remaining abutments were free from Periapical pathosis. General conservative treatment for existing teeth was done and periodontal therapy and mouth preparation as slight modification to the existing teeth were accomplished . The patients were trained to properly accomplish oral hygiene procedures& were convinced for the acceptance of the prosthesis.

The patients were equally divided into two groups seven patient in each, patients received conventional overdenture in Group (A) while in Group (B)patients received Lined overdenture, with softliner as a permanent heat cure softliner (fig. 2).The material used for lining the overdenture in this study was BITEM9 (BitemCavex Holland **B.V.** P.O. Box 852/RW,Naarlem-Holland. Bitem, Angel Reline it,' Apple Dental Ventures Inc. 18485 KeeleSt.N. Newmarket, Ontario Canada L3Y **4V9.**) Soft lining denture material.

A study cast was obtained from primary alginate impressions. Then a secondary impression was made to obtain master cast (Fig. 3). Record blocks were constructed on master casts for recording occlusal relationship. The trial overdenture bases were checked in the patient's mouth then processed, finished & polished. (Figure4).The conventional overdenture was inserted in the patient's mouth.

Relining of the overdenture for group (B) was made by making an impression with the overdenture. Attention was paid to insure that the patient was closed in intercuspal position. The cast which obtained from impression was coated with a separating medium while the border and the fitting surface of the overdenture was primed well with the monomer given by the manufacturer. As recommended by the manufacturer 1.5-2 parts powder: 1 part liquid by volume was mixed in air tight mixing glass jar and allowed to reach the dough stage which was ready to pack, within two minutes or less. The overdenture was packed. Two sheets of cellophane papers were used to cover the acrylic reline dough to prevent its adhesion to the cast surface during the trial closure.

The flask was closed under press with gradually increasing the force to permit adequate time for BITEM to flow then clamped tightly and applied pressure slowly until the flask was closed completely. The trial packing procedure was repeated then, the cellophane papers were removed and the two halves were closed. The flask was submersed in a water bath for curing (fast curing is recommended by the manufacturer). The temperature was raised to 74'C and maintained for one and half hours and then increasing the temperature of the water bath to boiling for an additional 30 minutes [24]. The flask was then allowed to bench-cool at room temperature before deflasking. The relined overdentures were trimmed and smoothed (Figures 5&6), then inserted in patient mouth.

All patients in groups (A) & (B) were instructed to maintain their meticulous oral hygiene by using tooth pastes, brushes, dental floss, antiseptic mouth wash and rubber tips. Once daily of 0.4% tannous fluoride gel, which was used as home care fluoride gel. It was brushed thoroughly on the abutment teeth and the gel was allowed to remain for 1 minute then instructed for follow up at one week, three & six months.

Clinical evaluation:

For the standing teeth the following was done:

- Pocket depth (PD) according to Ramfjord[25].
- Gingival index (GI) according toLoe&Silness[26].

2-Electromyographic Evaluation (EMG):

For all patients Electromyographic records were done at Physical Medicine &Rehabilitation Department, Faculty of Medicine, Tanta University by an Electromyographic apparatus**(Neuropak II NEM-7102A/K- Nihon Kohden, made in Japan).*

The masseter muscles activity was measured bilaterally from the beginning of chewing until swallowing, as expressed by the mean value of the amplitude of motor unit action potentials measured in microvolts (pV), which was printed automatically by the electromyography. Chewing time was measured from the beginning of chewing until swallowing. It was recorded by using stop watch in seconds(s). Chewing strokes were obtained by counting the number of EMG bursts during this period (Figure 7). The Evaluation was done at time of insertion, one week, 3 months and 6 months' interval.

Statistical analysis

Results were tabulated and statistical analysis was performed with Statistical Package for Social Science (SPSS version 13). Comparison between two groups was done using Mann-Whitney U test (Z test) as a nonparametric test equivalent to t-test which depends on using the ranks of cases. For comparison between more than two means, the F value of analysis of variance (ANOVA) was calculated and Scheffe test was performed to compare between each two means. Comparison between two proportions was done using (Z test) as Z (test of proportion). *P* values of< 0.05 were considered statistically significant[26].

Figure 1: patient with hypodontia.

Figure 2: Bitem soft liners.

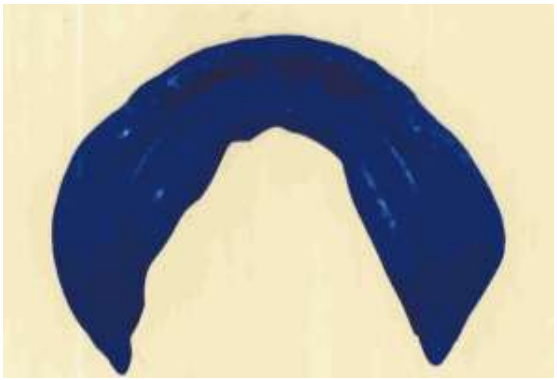


Figure 3 upper & lower rubber base impressions.

Figure 4 the fitting surface of the overdenture without relining.

Figure 5: the fitting surface of the overdenture after relining.

Figure 6: the patient after insertion of overdenture.

Figure 7: Electromyographic apparatus.

3. Results

1-Clinical results:

Pocket Depth (PD)

The PD in group (A) (conventional overdenture) & group B (lined overdenture) revealed that there was no significant change at different intervals from baseline without overdenture, after one week and 3 to 6 months from overdenture insertion. The mean& standard deviation (SD) of (PD) at baseline without overdenture was (2.92±0.51) which increased to (3.27±0.34) after 6 months in group A & (2.62±0.53) which increased to (2.96±0.41) after 6 months from overdenture insertion in group B .In comparing the PD between group (A) and (B) revealed that there was no statistically significant difference between both groups at baseline without overdenture, after one week, 3 months and 6 months from overdenture insertion. Table (1) and graph.

Gingival Index (GI)

Table (2) and graph (2) revealed that there was no statistically significant change in GI at baseline without overdenture, one week, after 3 and 6 months from overdenture insertion in groups A & B. For group (A), the mean ± SD of (GI) at baseline without overdenture was (1.04±l.41) which showed slight increase to (1.06±0.42) after one week. Then (GI) increased after 3 and 6 months to (1 .34±0.52) and (l.46±0.46) respectively. Regarding the (GI) scores in group (B), the mean ± SD of (GI) at baseline without overdenture was (1.03±l.40) which showed slight decrease to (1.0±0.43) after one week. Then (GI) increased after 3 and 6 months, this was (1 -23±0.39) and (1.33±0.39) respectively. The mean value in both groups showed no statistically significant difference at different follow up periods.

2-Electromyographic results:

EMG activates

The EMG activates was measured from the beginning of chewing until swallowing of a peanuts. The sum of both mean values amplitude of the left and right masseter muscle activity were used

Table (3) and graph (3) show the mean ± SD of the mean value EMG amplitude of the masseter muscle activity of group (A), at baseline without overdenture was (611.43±9.67) which decreased by time to (511±110.07) after 6 months from overdenture insertion. This decrease was not statistically significant. The mean ± SD of mean value EMG amplitude of the masseter muscle activity of group (B), at baseline without overdenture was (612.86± 103 .07) which decreased to (424.29±99.64) after 6 months from overdenture insertion which was statistically significant at (P<0.05). This significant difference was found in comparison between at base line without out overdenture insertion (1) versus 6 months from overdenture insertion (IV) as well as after one week (11) versus 6 months while when comparing the mean value of the EMG amplitude of the masseter muscle activity of both groups (A) & (B). There was not statistically significant difference were found between the two groups in all intervals.

The changes among the comparable values of the EMG amplitude of the masseter muscle activity of groups (A) & (B) are expressed in percent as shown in the table (4) and graph (4). The mean values of percents of change of volt amplitude of masseter muscle activity during chewing after 3 months and after 6 months from base line among group (A) was (12%) and more decrease (16%) respectively which is not significant. The same pattern in group (B) as the mean values of percents of change of volt amplitude of masseter muscle activity during chewing after 3 months and after 6 months from base line was (15%) and more decrease (26%) respectively which was not significant. In comparison between the two groups (A) & (B) in the percents of change of (EMG) activates after 3 months from base line was (12%) in group (A) and (15%) in group (B) and this was not significant. While the percent's of change of (EMG) activates after 6 months from base line were (16%) and (26%) for group (A) and group (B) respectively and this was statistically significant (p<0.05).It was clear that the percent of change in the EMG amplitude of the masseter muscle activity of group (B) was

higher than in group (A), specially after 6 months from base line.

Chewing time

Chewing time was measured from the beginning of chewing until swallowing in seconds. Table (5) and graph (5) showed the mean ± SD of chewing time in group (A), at baseline without overdenture was(50.7I±I0.I8) which decreased to (44.14±II.I0), (37.00±9.7I) and(29.86±10.90) after one week,3 and 6 months from overdenture insertion respectively. This decrease was statistically significant (*P*<0.05). This significant difference was found in comparison between the results at base line without overdenture (1) versus after 6 months from overdenture insertion (IV) follow up. The mean ± SD of the chewing time in group (B), at baseline without overdenture was (49.29±9.76) which decreased to (43.14±IO.88), (30.29±IO.89) and (19.14±3.67) after one week, 3 and 6 months from overdenture insertion respectively. This decrease was statistically significant at (*P*<0.05) in comparison between results of at base line (1) versus after 3 (III) and 6months(IV) follow up as well as after one week (11) versus after 6 months from overdenture insertion (IV) follow up. In comparing the mean values of chewing time of both groups (A) & (B). There was no statistically significant difference found between the two groups at baseline without overdenture, after one week and 3 months from overdenture insertion. But after 6 months from overdenture insertion, there was statistically significant difference between the two groups at (*P*<O.05).

The changes among the comparable values of chewing time in groups (A) & (B) are expressed in percent as shown in the table (6) and graph (6) showed the mean values 0 f percents of change of chewing time after 3 and 6 months from base line among group (A) which was (27%) and more decrease (4 1%) respectively which is not significant. The same pattern in group(B) as the mean values of percents of change of chewing time after 3 and 6 months from base line was (40%) and more decrease (60%) respectively which was statistically significant (*P*<O.05). In comparison between the two groups (A) & (B) the mean values of percents of change of chewing time after 3 months from base line was (27%)in group(A) and more decrease (40%) in group (B) and this was not significant. While the percents of change after 6 months from baseline became (41%) and (60%) for group (A) and group (B) respectively and this was statistically significant (*P*<O.05) as shown in the table (6) and graph (6). It was clear that the percents of change in chewing time of group (B) were higher with more decrease than in group (A).

Chewing strokes

Chewing strokes were obtained by counting the number of EMG bursts during this period (from the beginning of chewing until swallowing). Table (7) and graph (7) show the mean values of chewing strokes of group (A). The mean ± SD at baseline without overdenture was (19.57±1.27) which decreased to (17.97± 1.61), (16.29±1.80) and (13.14±2.27) after one week, 3 and 6 months from overdenture insertion respectively. This decrease was statistically significant (*P*<O.05). This significant difference was found in comparison between at base line without overdenture insertion (1) versus after 3 (III) and 6 months (IV) follow up, as well as after one week from overdenture insertion (11) versus after 6 months (IV) also after 3 months from overdenture insertion (III) versus after 6 months (IV).The mean values of chewing strokes of group (B). The mean ± SD at baseline without overdenture was (I9.14±1.49) which decreased to (17.93±1.64), (14.71±1.80) and (II.00±I.53) after one week, 3 and 6 months from overdenture insertion respectively. This decrease was statistically significant at (*P*<O.05), and this significant difference was found in comparison between at base line without over denture insertion (1) versus after 3 (III) and 6 months from overdenture insertion (IV) follow up, as well as after one week from overdenture insertion (11) versus after 3 (III) and 6 months (IV), also after 3 months (III) versus after 6 months (IV) follow up.

In comparing between both groups (A) & (B). There was no statistically significant differences found between the two groups at baseline without overdenture, after one week and 3 months from overdenture insertion. But after 6 months from overdenture insertion there was statistically significant difference was found between the two groups at (*P*<O.05).

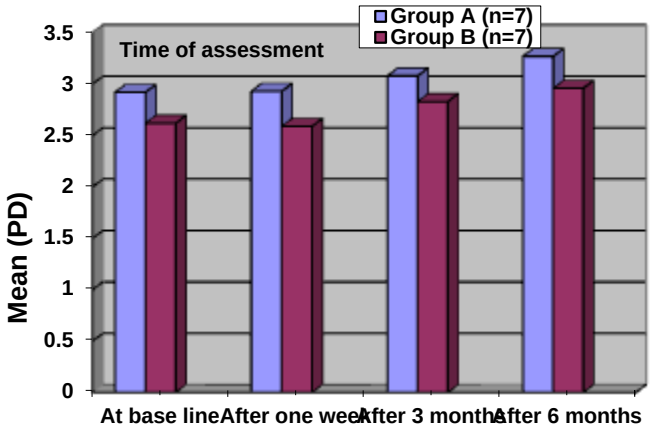
The changes among the comparable mean values of chewing strokes in group (A) are expressed in percent as shown in the table (8) and graph (8) showing the mean value of percents of change of chewing strokes after 3 and 6 months from baseline, which was (18%) and more decrease (33%) respectively, that was statistically significant at (*P*<O.05). The same pattern in group (B) as the mean value of percents of change of chewing strokes after 3 and 6 months from base line was (23%) and more decrease (42%) respectively which was statistically significant at(*P*<O.05).In comparison between the two groups (A) & (B) the percents of change of chewing strokes after 3 months from base line was (18%) in group (A) and(23%) in group(B) and this was not significant. While after 6 months from base line was (33%)for group (A) and more decrease (42%)for group (B)and this was statistically significant (*P*<O.05)).It was clear that the percent of change in chewing strokes of group (B)was higher than in group (A)

Table (I): Mean values of Pocket Depth (PD) among the study groups at base line, after one week, 3 and 6 months from overdenture insertion.

Time of assessment		Pocket Depth (PD) among the study groups		Z-test *P*
		Group A (n=7)	Group B (n-7)	
At base line (1)	Range Mean± SD Median	2.30-3.60 2.92±0.51 2.71	1.90-3.15 2.62±0.53 2.90	1.086 ns 0.277
After one week (11)	Range Mean± SO Median	2.30-3.60 2.93±0-52 2.71	1.90-3.15 2.59±0.56 2.90	1.086ns 0.277
After 3 months (III)	Range Mean± SD Median	2.70-3.60 3.08±0.40 2.80	2.20-3.20 2.83±0.41 3.10	1.091 ns 0.275
After 6 months (IV)	Range Mean± SD Median	3.00-3.70 3.27±0.34 3.00	2.40-3.40 2.96±0.41 3.20	1.101 ns 0.271
F-test P Scheffe*test*		0.931 ns 0.441 IV>III>II>I	0.895 ns 0.458 IV>III>II>I	

z (Mann-Whitney U) ns =not significant or P>O.05 Group A= Patients with conventional overdenture.
Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (1): Mean values of Pocket Depth (PD) among the study groups at base line, after one week, 3 and 6 months from overdenture insertion.



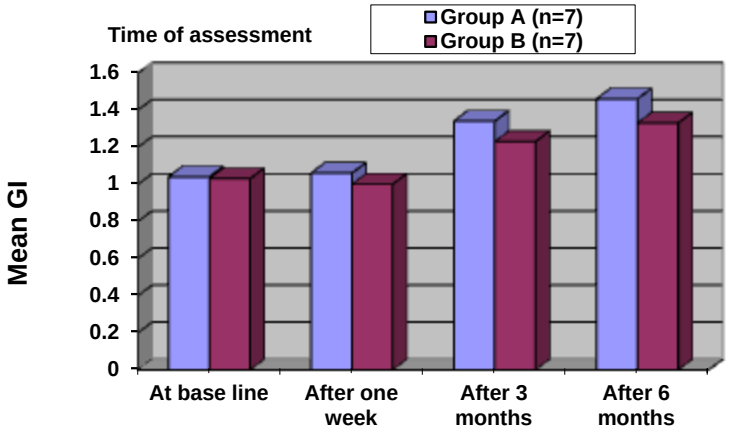
Group A= Patients with conventional overdenture Group B= Patients with overdenture lined with Bitem as permanent soft liner

Table (2): Mean values of Gingival Index (GI) among the study groups at base line, after one week, ~ and 6 months from overdenture insertion.

Time of assessment		Gingival Index (GI) among the study groups		Z-test *P*
		Group A (n=7)	Group B (n-7)	
At base line (1)	Range Mean± SD Median	0.40-1.70 1.04±0.41 1.00	0.55-1.70 1.03±0.40 1.00	0.129 ns 0.897
After one week (11)	Range Mean± SO Median	0.45-1.75 1.06±0.42 1.10	0.50-1.70 1.00±0.43 1.00	0.320 ns 0.749
After 3 months (III)	Range Mean± SD Median	0.70-2.00 1.34±0.52 1.30	0.50-1.70 1.23±0.39 1.20	0.385 ns 0.700
After 6 months (IV)	Range Mean± SD Median	0.90-2.10 1.46±0.46 1.40	0.70-2.00 1.33±0.39 1.30	0.647 ns 0.517
F-test *P* Scheffe test		1.444 ns 0.255 IV>III>II>I	1.084 ns 0.375 IV>III>II>I	

ns = not significant or P>O.05 *Significant or P<O.05
Z (Mann-Whitney U) Group A= Patients with conventional overdenture.
Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (2): Mean values of Gingival Index (GI) among the study groups at base line, after one week, 3 and *4* months from overdenture insertion.



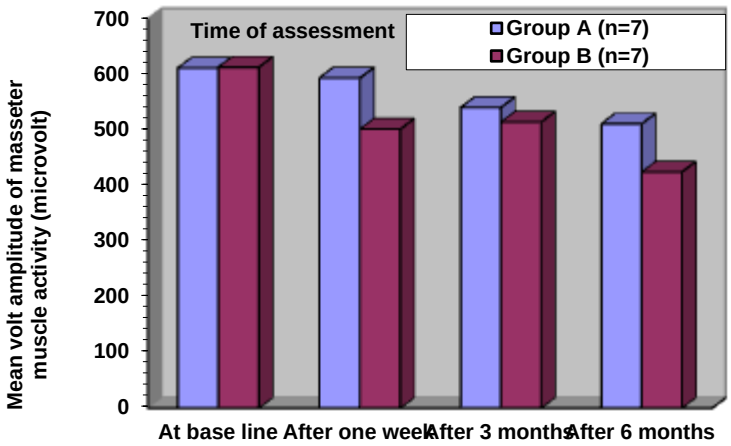
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Table (3): Mean values of EMG amplitude of masseter muscle activity during chewing (microvolt) among the study groups at base line, after one week, 3 and 6 months from overdenture insertion.

Time of assessment		Electromyographic (EMG) activates among the study groups		Z-test *P*
		Group A (n=7)	Group B (n-7)	
At base line (1)	Range Mean± SD Median	500-700 611.43±79.67 640	450-720 612.86±103.07 650	0.257 ns 0.797
After one week (11)	Range Mean± SD Median	500-700 593.43±79.47 600	420-690 501.57±102.82 635	0.128 ns 0.898
After 3 months (III)	Range Mean± SD Median	430-650 540.29±99.30 580	400-620 514.29±76.35 500	0.384 ns 0.701
After 6 months (IV)	Range Mean± SD Median	306-600 511±110.07 540	270-540 424.29±99.64 420	1.544 ns 0.123
F-test *P* Scheffe*test*		1.748 ns 0.184 IV>III>II>I	5.543 ns 0.005 IV>III>II>I I vs IV. P* (0.012) II vs IV. P* (0.03)	

ns = not significant or P>O.05 Significance: *P<O.05 Z (Mann-Whitney U)
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (3): Mean values of EMG amplitude of masseter muscle activity during chewing (microvolt) among the study groups at base line, after one week. 3 and 6 months from overdenture insertion.



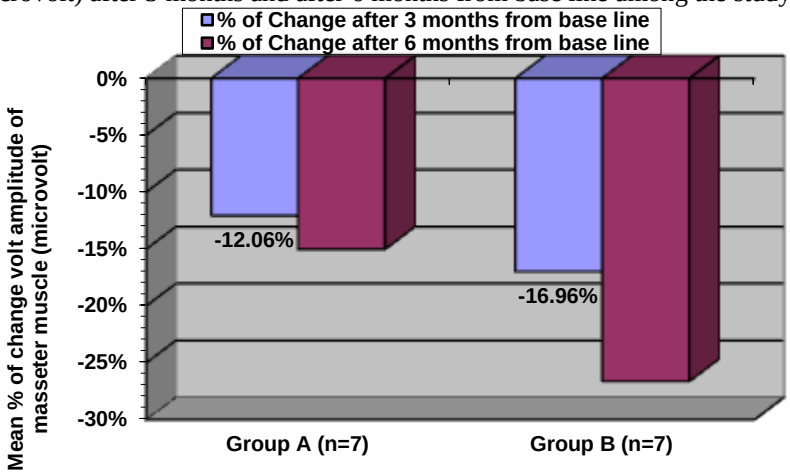
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Table (4): Mean values of percents of change of EMG amplitude of masseter muscle activity during chewing (microvolt) after 3 months and after 6 months from base line among the study groups.

% of change		% of change of Electromyographic (EMG) (microvolt) activates among the study groups		Z -test *p*
		Group A (n=7) %	Group B (n=7) %	
Change after 3months from baseline	Range Mean±SD Median	↓ 24.21 -↓ 6.25 ↓ 12.06±6.78 ↓9.37	↓ 27.78 -↑ 11.11 ↓ 15.01±13.08 ↓16.36	1.342 ns 0.180
Change after 6months from base line	Range Mean±SD Median	↓ 42.26 -↓ 7.72 ↓ 16.96±11.64 ↓14.28	↓ 49.06 -↓14.67 ↓ 26.62±11.05 ↓24.44	2.111 0.035*
Z –test *P*		0.643 ns 0.337	1.469 ns 0.142	

Z (test of proportion) *Significance or *P*<O.05 ns = not significant or *P*>O.05
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (4): Mean values of percents of change of EMG amplitude of masseter muscle activity during chewing (microvolt) after 3 months and after 6 months from base line among the study groups



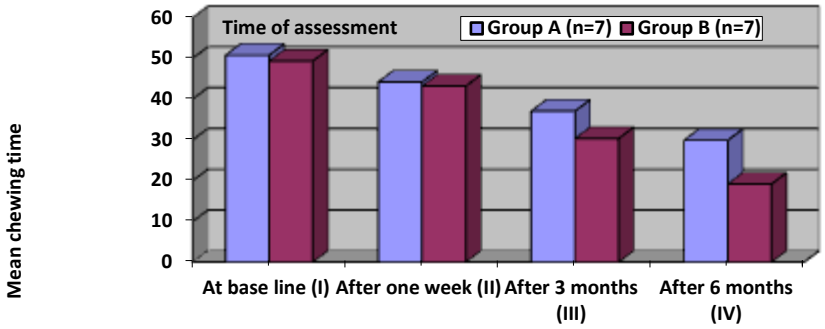
Group A= Patients with conventional overdenture Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Table (5): Mean values of Chewing time among the study groups at base line, after one week, 3 and 6 months from overdenture insertion.

Time of assessment		Chewing time (seconds) among the study groups		Z-test *P*
		Group A (n=7)	Group B (n=7)	
At base line (1)	Range Mean± SD Median	35-65 50.71±10.18 50.00	40-65 49.29±9.76 45.00	0.268 ns 0.793
After one week (11)	Range Mean± SD Median	28-59 44.14±11.10 42.00	28-59 43.14±10.88 40.00	0.193 ns 0.847
After 3 months (III)	Range Mean± SD Median	25-50 37.00±9.71 34.00	18-45 30.29±10.89 27.00	1.233 ns 0.218
After 6 months (IV)	Range Mean± SD Median	16-45 29.86±10.90 30.00	15-25 19.14±3.67 20.00	1.994* 0.046
F-test *p* Scheffe test		5.158* 0.007 I>II>III>IV I vs IV,P* (0.02)	14.663* <0.001 I>II>III>IV I vs III & IV, p* (0.009, <0.001) II vs IV, p* (0.001)	

*Significance or *P*<O.05 ns = not significant or P>O.05 Z (Mann-Whitney U)
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (5): Mean values of chewing time (seconds) among the study groups at base line, after one week, 3 and 6 months from overdenture insertion.



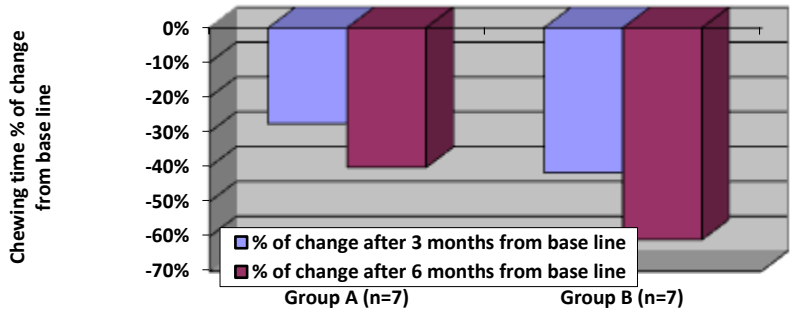
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Table (6): Mean values of percents of change of chewing time after 3 months and after 6 months from base line among the study group.

% of change		% of change of chewing time among the study groups		Z-test *P*
		Group A (n=7) %	Group B (n=7) %	
Change after 3months from baseline	Range Mean± SD Median	↓40.00-↓16.67 ↓27.55±8.09 ↓28.57	↓55.00-↓25.00 ↓40.11±10.29 ↓40	1.096 ns 0.170
Change after 6months from baseline	Range Mean± SD Median	↓64.44-↓-23.64 ↓41.70±15.67 ↓40	↓69.23-↓55.55 ↓60.86±4.91 ↓60	2.175* 0.030
Z-test *P*		1.221 ns 0.096	3.144* 0.002	

Z (test of proportion) *Significance or *P*<O.05 ns = not significant or *P* >O.05
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (6): Mean values of percents of change of chewing time after 3 months and after 6 months from base line among the study groups.



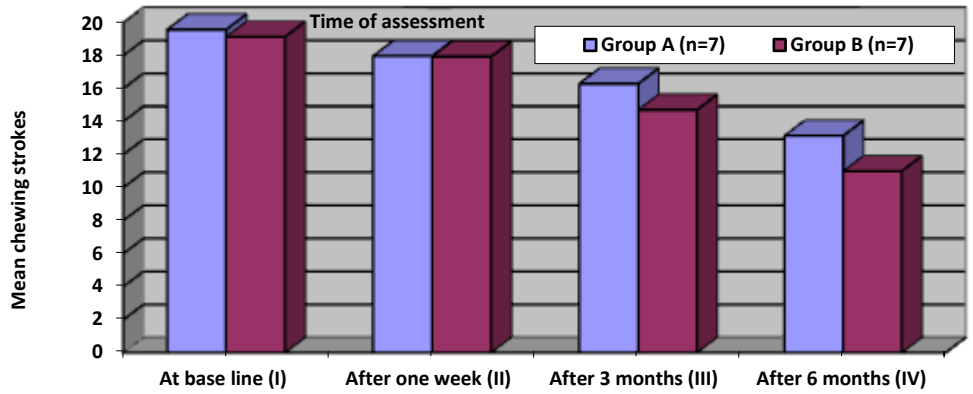
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Table (7): Mean values of Chewing strokes among the study groups at base line, after one week, 3 and 6 months from overdenture insertion.

Time of assessment		Chewing strokes among the study groups		Z-test *P*
		Group A (n=7)	Group B (n=7)	
At base line (I)	Range Mean± SD Median	18-22 19.57±1.27 19.00	17.50-22 19.14±1.49 19.00	0.855 ns 0.392
After one week (II)	Range Mean± SD Median	16-20 17.97±1.61 18.80	16-21 17.93±1.64 17.50	0.065 ns 0.948
After 3 months (III)	Range Mean± SD Median	14-19 16.29±1.80 16.00	12-17 14.71±1.80 15.00	1.357 ns 0.175
After 6 months (IV)	Range Mean± SD Median	11-17 13.14±2.27 12.00	10-14 11.00±1.53 10.00	2.088* 0.037
F-test *p* Scheffe test		16.792* <0.001 I>II>III>IV I vs III & IV, p* (0.019,<0.001) II vs IV, p* (<0.001) III vs IV, p* (0.027)	19.406* <0.001 I>II>III>IV I vs III & IV, p* (<0.001) II vs III & IV, p* (0.011,<0.001) III vs IV, p* (0.003)	

*Significance or *P* <O.05 ns = not signiflcant or *P* >O.05 Z (Mann-Whitney U)
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Graph (7): Mean values of chewing strokes among the study groups at base line after one week, 3 and 6 months from overdenture insertion.



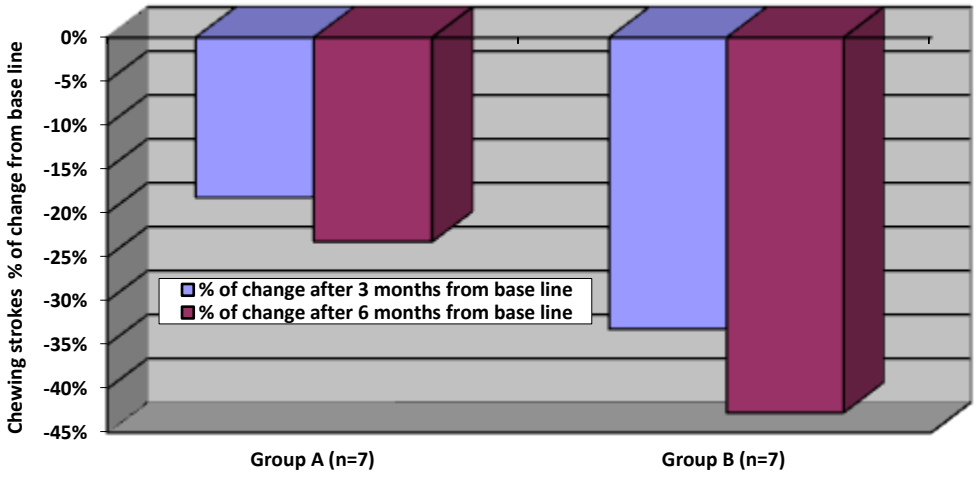
Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

Table (8): Mean values of percents of change of chewing strokes after 3 months and after 6 months from base line among the study groups.

% of change		% of change of chewing time among the study groups		Z-test *P*
		Group A (n=7) %	Group B (0=7) %.	
Change after 3 months from base line	Range Mean± SD Median	↓35. 71-↓10.00 ↓18.22±8.86 ↓15	↓31.58- ↓15.79 ↓23.24±6.09 ↓22.22	1.471 ns 0.141
Change after 6 months from base line	Range Mean± SD Median	↓42.1 0-↓-22.73 ↓33.16±7.73 ↓33.33	↓47.37- ↓36.36 ↓42.71±4.06 ↓42.86	2.241 * 0.025
Z -test *P*		2.625* 0.009	3.134* 0.002	

Z (test of proportion) *Significance or *P* <O.05 ns = not significant or *P* >O.05
Group A= Patients with conventional overdenture. Grouo B= Patients with overdenture lined with Bitem as oennanent soft liner.

Graph (8): Mean values of percent of change of chewing strokes after 3 months and after 6 months from base line among the study groups.



Group A= Patients with conventional overdenture. Group B= Patients with overdenture lined with Bitem as permanent soft liner.

4. Discussion

One of the main goals of dentistry is to preserve a lifelong healthy masticatory function. Recent studies have shown that mastication is of great importance, not only for the intake of food but also for the systemic and physical functions of the body[28]. Wong *et al.* (2005)[29] said that "the oral health status of children and adolescents with hypodontia has not been fully investigated.

Prosthodontic treatment may commence at an early age of 3-4 years as it enhances conditions for growth and development of orofacial structures.[30]

Although dentures are poor alternatives to healthy dentition, they create conditions for maintenance of a normal, satisfactory daily diet, thus

helping to establish a lifelong dietary pattern at an early age. Also, in the absence of occlusal stops (or dentures), the anterorotation of the mandible causes an upward and forward displacement of the chin, with a reduction in the height of the lower-third of the face; a tendency to C1 III malocclusion. Dentures help positioning of the chin in place.[31]

Children adapt readily, to removable prostheses with proper preparation and motivation[32]. According to Oesterle *et al.* (1993)[33] and Cronin *et al.* (1994)[34] possible consequences of early implant placement include implant submergence because of jaw growth, implant exposure because of bone resorption associated with jaw growth, implant movement because of jaw growth, and limitation of jaw growth if the implants are connected by a rigid prosthesis that crosses the midline.

Overdentures are the most desirable treatment option[35, 36]. Overdenture has an added advantage, that they preserve the alveolar bone. As a result of continuing growth and development. Also, overdenture gave an excellent cosmetic and functional results[16, 37]

The age of the participants was ranging between 12-18 years to avoid the effect of age changes on their chewing force and their corresponding muscle activity.[38]

Patients were selected with good oral hygiene as the critical factor in the selection of patients (Oredugba, 2005)[39] reported that motivation and comprehension toward oral hygiene are important factors in the successful long-term treatment to the patient with hypodontia.

In the present study BITEM was used because it is an acrylic permanent liner material and this is in accordance with Murata *et al.* (2002)[40] who advocated that the most marked improvement in masticatory function was greater in dentures lined with acrylic permanent materials.

Electromyographic was used in this study to evaluate muscle activity because EMG recordings of jaw muscle activity during chewing have revealed details of the pattern of activity of muscles that control the jaw as reported by (BradleY,1995)[41]. Surface electrode was preferred in this study and not needle electrode to eliminate the pain on insertion of the needle and stress which may affect the electromyographic recode[42] and it is effective in recording both superficial and deep fibers of Masseter muscle activity without pain and allow good evaluation of the integrated activity of the muscle beneath them as found by (Belser and Hannam, 1986)[43]. Huang *et al.* (2005)[44] recommended surface electrode to be used in muscle recording because surface electrode has the advantages of easy to use, noninvasive, large recording region and more safe.

The masseter muscle was chosen in this study because it is considered to be the most powerful and obvious muscle of mastication and is highly active during mastication as stated by (El-Zawahry, 1998[45]; Fehrrenbach and Herring, 2007)[46]. The EMG activity of the masseter muscle was evaluated without overdenture, then one week, three months and six months after overdenture insertion to allow muscle accommodation as recommended by (E1Bagoury, 1995).[47]

Present study showed no significant differences in clinical parameters including pocket depth, gingival index for the abutments in and between both groups during the period of the study. This may be explained that the patients were instructed to properly use toothpastes, brushes, and dental floss to remove food particles and dental plaque. In addition to the use of fluoride applications which was of great benefit. This was in accordance with the results of (Toolson and Taylor, 1989[48] & Vergo, 2001)[49].

Higher muscle activity may be considered as regards preservation of a healthy functioning muscle and good masticatory efficiency, as well as delaying aging muscle atrophy. Lower masticatory muscle activity may also be considered well as giving the same masticatory efficiency but with markedly less muscular effort and fatigue as discussed by (Aly, 1994)[50].

In the present study masseter muscle showed decrease in the activity in both groups. This decrease might be due to alterations in vertical jaw relation from base line without overdenture to other follow up assessments after insertion. This agreed with (Tallgren *et al.*, 1983)[51] who stated that after insertion and use of the denture there was an increase in occlusal vertical dimension which associated with a decrease in mean voltage of Masseter muscle.

The results of the present study showed that several variables (EMG amplitude, chewing time and chewing strokes) related to masticatory function improved in the lined overdenture group more than conventional overdenture group, also the percents of change after 3 and 6 months from base line were higher in lined overdenture than conventional overdenture. This improvement can be explained by Kawano *et al.*, 1993[52] who reported that soft liners possess properties that reduce and disperse the masticatory force. The soft liner absorbs some of the energy produced by masticatory impact. Hence soft liners serve as a shock absorber between the occlusal surface and underlying oral tissue.

In present study the subjects chewed faster with fewer chewing strokes occurred with lined overdenture group that might be due to improve the fit of the denture, retention and stability as reported by (Garrett *et al.*, 1996)[53]. Moreover this remarkable reduction in chewing strokes and chewing time in lined overdenture group which indicated improvement of masticatory function with the use of lined overdentures. Less chewing strokes and shorter chewing time are usually considered compensation for improvement in masticatory function (Shinkai, 2001)[54].

This decrease in muscle activity in lined overdenture group may be explained due to decrease the magnitude of forces transmitted to the underling tissue. This was in accordance with Riad, (2000)[37].While in contradistinction to the pervious findings (Perez *et al.,* 1985)[55] who reported that the improvement of retention and stability by modifications as correction of gross occlusal prematurities and by the use of a denture adhesive or base reline did not significantly alter the chewing performance or muscle activity during mastication in denture wearers. Such disagreement may be attributed to that in their study the denture wearers were not given the opportunity to adapt to a modification before testing.

Generally speaking, there was a gradual decrease, in the EMG activity of the Masseter muscle, chewing time and strokes in conventional overdenture, and more decrease in lined overdenture, this means that the patient was accommodated to the overdenture and the patient could control it well to the extent that no need to much muscular activity to masticate food and in less time. This agreed with (Badr, 2002)[56].

Conclusion

The use of overdentures was a good solution for the patients suffering from hypodontia improving aesthetic, psychology and masticatory activity. Motivation, comprehension toward oral hygiene and use of fluoride are important factors in the successful long-term treatment so that patients must be recalled at frequent intervals for oral examination and home care review and reinforcement. The use of soft liner with overdentures was of great benefit for the patients as there was decrease in EMG activity of masseter muscle.

The improvement of masticatory activity was due to the cushion like effect of the soft liners which decreased the transmitted forces on the residual ridges and reduce the impact of the occlusal force. The uses of soft liner give the chance to increase retention and stability of the overdenture.

Also elimination of soreness or pain under the overdenture. The number of chewing time and chewing strokes were significantly decreased. The percents of change after 3 and 6·months from base line in lined overdentures was more than conventional overdenture, this indicate that masticatory function improved with the use of lined overdenture.

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