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A clinical Study of Complete and Partial Denture Fracture at Four Hospitals in Iraq

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Abstract

Objective: To analyzes and determines the prevalence of type of denture fracture in four hospitals.

Method: Data were collected from patients who attended prosthodontic clinics for denture repairs at four hospitals. For each patient requiring of a fractured complete and partial denture, the variables were recorded: causes of denture fracture, the type of fracture and the history of previous recurrent fractures.

Results: Of 560 repaired denture 330 (59%) were complete dentures, 160 (30%) were removable partial denture, which were excluded from the study, and 70 (10%) involved replacement of the teeth that had debonded from the denture bases. The ratio of upper to lower complete denture fractures was approximately 2:1, most of the fractured dentures (65%) were those of males.

Poor fit appeared to be the main cause of denture fracture 120 (20%), and poor occlusion was the second most common case recorded 50 (8%) .Midline fracture was the most common type of fracture during the period of study 210(40%). Most of fracture the fractured dentures 180 (32%) had previously been repaired once or more.

Conclusion: The total number of complete denture fractures was considerably enhanced by repetitive fractures, which can be reduced by the application of prosthetic principles in constructing and maintaining dentures particular during the laboratory stages.

Improvements in the processing techniques and the type of resin can reduce the incidence of denture fracture .Various polymers have been developed for use as denture base resins to overcome some of the mechanical deficiencies of polymethylmethacrylate .

Key Words: Complete denture fractures, Acrylic resins, Prosthodontics.

Introduction

Repair of denture fractures is stall a common problem in prosthodontics .With denture fracture ,patient may be affected esthetically ,functionally ,and psychologically .In addition, will carry additional costs .There is no information about the causes and patterns of fracture of acrylic denture in Iraq.

Denture repairs involve joining two parts of a fractured denture with a denture repair material. Satisfactory repairs must have adequate strength, be easily and rapidly completed, mach the original color of the material, retain its dimensional accuracy [(1)] and restore the original strength of the denture so as to avoid further fracture**,** but this is

not always possible [2]. The fracture of acrylic resin dentures is an unresolved problem in removable prosthodontics [1-3]. Attempts to analyze and determine the cause of such fractures have received considerable attention in recent years [2-4]. A multiplicity of factors may be responsible for the ultimate failure of a denture and failure is not necessarily due to the intrinsic properties of the denture base material [5].

Fractures in dentures result from two different types of forces, namely flexural fatigue and impact. Flexural fatigue occurs after repeated flexing of a material and is a mode of fracture whereby a structure eventually fails after being repeatedly subjected to loads that are so small that one application apparently does nothing detrimental to the component. Impact failures normally occur out of the mouth as a result of a sudden blow to the denture or accidental dropping due to cleaning, coughing or sneezing [2-6-7] Fractures are more common in the midline of maxillary complete dentures , furthermore, fractures of repaired dentures often occur at the junction of old and new material rather than through the centre of the repair [8].

The material most commonly employed in the construction of dentures is the acrylic resin (poly methyl methacrylate). This material is not ideal in every respect but it is the combination of virtues rather than one single desirable property that accounts for its popularity and usage. Despite its popularity in satisfying aesthetic demands whereby, with an appropriate degree of clinical expertise and with the careful selection and arrangement of artificial acrylic teeth, it is possible to produce a prosthesis, which defies detection, it is still far from ideal in fulfilling the mechanical requirements of a prosthesis [9] .

The purpose of this study was to identify the cause of the most frequent types of complete and partial denture fractures, which could be related to patients, clinicians and technique.

Method

Data were collected from for prosthodontic clinics attached to prosthetic to prosthetic laboratories in four hospitals during **16 months.** Patients attended for repair of broken dentures were examined and the following data were recorded.

1-Patients age and gender.
2-Denture age at time of fracture.
3-Denture type (complete or partial, acrylic or metal) previous or recurrent fractures.

To determine the cause and type of fracture, only repaired complete dentures were subjected to careful examination outside and inside the mouth for retention and stability of the denture, type and location of fracture, occlusal contact errors and nature of opposing teeth (natural or artificial ,partial or complete denture)

Retention of repaired denture was evaluated by examining the resistance of denture to displacement on removing the denture from the mouth.

Broken dentures were repaired with conventional procedure by using auto polymerizing acrylic resin. Examination and evaluation of repaired dentures were carried out by the same operator in all hospitals .Statistical analysis was accomplished by using SPSS. Chi-square test was used to compare categories, the result was considered statistically significant when probability was less than 0.05.

Results

During the study period, a total of 560 dentures were repaired ,330 (59%)were broken complete dentures

,70(11%) involved replacement of teeth that had debonded of fractured from the denture base ,and the remaining 160 (30%) were broken removable partial dentures. (Table 1).Removable partial dentures were excluded from this study, because the nature of repairs and the causes of fracture differed from those observed with complete dentures.

The results showed that the ratio of upper to lower complete denture fractures was approximately 2:1 (Table II). Most of the fractured dentures (65%) were related to males, and only 10 patients have more than one fractured denture, and 6 of these patients were males.

The mean age of the fractured lower dentures was slightly more than the upper, it was 9.1years for the lower, 7,5 years for the upper ,and the mean age for all the fractured dentures was 8.3 years (Table III) .

Upper complete dentures were most liable to lose a tooth during eating or after dropping compared with lower dentures, of 70 replacements of the teeth that had debonded or fractured 47(70%) were in upper dentures.

Midline fracture was the most common type of fracture in this study, 198 (62%), of those midline fractures, 145 (73%) occurred in the upper dentures, and 53 (28%) in the lower dentures (Table IV).

Using chi –square analysis revealed significant difference between the site of fracture in upper dentures and the site of fracture in lower dentures, P<0.001) .

Differences in the apparent cause of fracture between upper and lower dentures presented in (Table V). Poor fit was the main cause of fracture in upper dentures 90 (42%) ,whereas dropping was the main cause in the lower dentures 38 (25%). Lack of balanced occlusion was the second cause of fracture in upper dentures 46 (20%), while it was the third cause of fracture in lower dentures 20 (15%). Highly significant difference was found between the causes of fractures in upper and lower dentures P<0.oo1)

Denture fractures occurred both outside and inside the mouth during function .The majority of upper denture fractures 230 (90%) occurred inside the mouth during function and the remainder 50 (10%) occurred outside the mouth, whereas out of 110 (64 %) repaired lower dentures inside the mouth, 60 (46 %) had been broken outside the mouth through impact as a result of dropping .

Less than one half 140 (42 %) of repaired had been repaired for the first time ,and the remainder 195 (58%) had previously been repaired once or more (Table VI). There was a difference in the incidence between upper and lower denture that had been repaired for the first time, (38% for the upper denture and 49% for the lower ones) .Statistical analysis of the data showed that no significant difference was found between the repetition of fractures in upper dentures and repetition of denture fractures in lower dentures P=0.27.

Discussion

Denture repaired material have been used in dentistry for more than a century. These materials play an important in modern prosthodontics. Denture repaired material must possess adequate physical and mechanical properties [10].

Midline fracture was the most common type of fracture in this study, represented 35% of the total denture repairs carried out. Of those 149 (62%) were seen in upper complete dentures and 53 (28%) were seen in the lower complete dentures. These findings are consistent with other studies [1-3]

,which have shown that midline fracture was a common problem in upper complete dentures .

Midline fracture of a denture base represents a flexural fatigue failure, resulting from cyclic deformation of the base during function. Any factor that alters the stress distribution of the denture base can predispose the denture to fracture [10]. Presence of deep incisal notches represent a point of weakness in that it might act as a stress raiser and so contribute to midline fracture of maxillary dentures , in this study the majority of upper dentures 110 (78%) which had been repaired of midline fracture , involved a notch in the midline .

Poor fit was the main cause of denture fracture in this study. Poor fit denture is flexed in the mouth during function about the midline or approximately. So, movement of the denture during mastication will case fracture due to a series of repeated small loadings, which lead to fatigue failure. If the notch is sufficiently sharp, the local stress concentration may exceed the breaking strength of the acrylic material and a crack will from which will run right through to complete failure under repeated loadings. Fracture of a denture in mouth by a single bite is very improbable, because the load required to cause fracture ranged from 180-800 Ib[5]. ,much higher than that which a denture wearer appears to be capable to produce during function , 13-16 Ib [10] , **Beyli and Von Fraunhofer (1981)** found that poor fit was the most common cause of denture fracture in 12 out of 15 dental laboratories involved in this survey [11] .

In the current study , poor occlusion was the second cause of denture , 66 (18%) dentures were fractured due to heavy or uneven masticatory loads .Of these 46(20%) wee single complete dentures opposed by a residual natural dentition , in such cases heavy masticatory load from the opposing natural teeth and unbalanced occlusion in the presence of inclined and over erupted natural teeth which oppose the denture will be the significant cause of denture, excessive wear of the artificial teeth can predispose the denture to fracture but other factors are probably more significant .

The results have shown that inadequate thickness and defect in acrylic base, such as voids inside the material, porosity, inclusions, deep scratches, and residual processing stresses fracture for 52 (16%) dentures. **Beyli and Von Fraunhofer (1) and Smith(5) ,** concluded from their study that sharp changes in contour , pin holes inclusions and deep scratches may all case stress intensification and will predispose the denture to Fracture . Fracture, however is the result of initiation and propagation of a crack and this requires the presence of point of localized stress [11].

Denture fracture occurs outside the mouth from impact as a result of accidents such as expelling the denture from the mouth while coughing or dropping the denture[12] .The liability of lower denture to accidental fracture is more than the upper , out of 58 (19%) accidental fractures 44(12%) occurred in lower dentures , and 14 (7%) were in upper dentures ,this difference in the incidence of accidental fractures between upper and lower dentures can be explained from the difference in the shape , size and width in the midline area between upper and lower dentures .

Ten percent of the fractured dentures were broken due to material breakdown with age; this represents a fatigue phenomenon, while long-time water and saliva sorption will lower the fatigue resistance of the acrylic resin. Hargreaves[2] concluded from her

study that the physical properties of methylmetacrylate did not deteriorate with age , but that clinical function may induce stresses which , after a period of a few years bring about deterioration in the denture base material and so hasten failure[13].

Most of the fractured dentures 198 (62%) had previously been repaired one or more times, and of these 64 (20%) had been repaired three or more time.

Auto polymerizing resin repairs provide a rapid and economic to patients but unfortunately the repaired units appear to lose 40% to 60%of their original transverse strength [14] . In addition to the technical deficiencies in the repair of dentures Smith (1961) found from his study that 56% of the total fractures had previously been repaired while only 6% had been repaired thee or more times , of these repairs 58% were cold –cured .

The result has shown that, 70 (10%) of the total repairs were replacement of the teeth that had debonded or fractured from the denture base resin. The most common causes which prevent optimum bonding between the teeth and denture base resin are indiscriminate use of separating medium and faulty boil out procedures, also tooth debonding may be exacerbated by unbalanced occlusion and heavy masticatory load.

Different precautions can be made to reduce the incidence of denture fractures though, maximal denture retention and stability, uniform occlusal lading and balanced articulation. Using higher strength polymers (high –impact resins) , a good processing technique to eliminate surface defects and inclusions within the denture base ,reducing the need for a deep frenal notch by a frenectomy , adequate thickness in the anterior region (the maximum consistent with tongue space) and placing a thin beading around the labial frenum to improve the seal . [15]

Metals can be added in the form of wires, plates or fillers to increase the transverse strength of acrylic resin [16] .

The reinforcement of acrylic resin with glass fibers in the form of a woven mat has been demonstrated to be a satisfactory way of producing a resin with improved mechanical properties [17] .

Conclusion

Despite advances in dental technology, it can be seen that the fracture of acrylic resin dentures remains a significant problem and the number of dentures has not decreased.

An analysis of the potential cause of fracture in 330 repaired dentures has shown that ,poor fit was the main cause of fracture, in the upper dentures, whereas dropping was the main cause of fracture in lower dentures .

Upper dentures were repaired more than lower denture (ratio 2:1). Midline fracture was the commonest type of fracture and more than half of repaired dentures (65%) had previously been repaired.

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Table I Type of denture repairs at each hospitals during the study period

Hospitals name	Complete denture repairs	Replacement of teeth	Partial dentures repairs	Total of repairs in each hospital	The time of survey
Al-Karkh General Hospital	95	15	23	133	**From August until November 2011**
AL-Kadhimiya teaching Hospital	55	14	17	76	**From December 2011 until March 2012**
Baghdad teaching Hospital	60	16	22	98	**From April until July 2012**
Babalmo adham specialized center for prosthodontic and orthodontic	120	25	98	243	**From August until end of November 2012**
Total of repair	330 (59%)	70 (11%)	160 (30%)	560 (100%)	

Table II. Number of upper and lower complete denture repairs in each

Hospitals name	Upper dentures	Lower dentures
Al-Karkh General Hospital	63	26
AL-Kadhimiya teaching Hospital	35	14
Baghdad teaching Hospital	46	20
Babalmo adham specialized center for prosthodontic and orthodontic	81	45
Total of repair	225	105

Table III.The number of fractured dentures in relation to denture age

Age –years	Number of dentures
0-3	65(20%)
4-6	95(29%)
7-9	62(19%)
10-12	48(15%)
13-15	32(9%)
More than 15	28(8%)
Total	330

Table IV . Differences in the site of fracture between upper and lower dentures *

Site of fracture	Upper dentures	Lower dentures
Midline fracture	149 (62%)	53(50%)
Between the central and lateral	42 (19%)	5 (4.5%)
Canine area fracture	15 (7%)	35 (32%)
Premolar area fracture	5 (4%)	5 (4.5%)
Molar ,tuberosity and retro molar pad area fracture	9 (6%)	6(5%)
Other areas fractures	5 (4%)	
Total	225	105

*X^2 = 40.30 P< 00

Table V .Differences in the cause of fracture between upper and lower *

Suggested cause of fracture	Upper dentures	Lower dentures	Upper dentures and lower dentures
Poor fit	90(40%)	29(29%)	119(36%)
Poor occlusion	38(17%)	14(13%)	52(17%)
Dropping	19(8%)	44(42%)	63(18%)
Defect in acrylic base (porosity ,scratches)	40(19%)	10(9%)	50(15%)
Material breakdown	16(6%)	8(7%)	24(8%)
Setting the teeth out of the ridge	22(10%)		22(6%)
Total	225	105	

*X^2 = 58.38 P< 001

Table VI . Repetition of fractures in upper and lower dentures

Repetition of repairs	Upper dentures	Lower dentures	Upper dentures and lower dentures
Dentures had been repaired for the first time	92(40%)	45(43%)	137(42%)
Dentures had been repaired once previously	56(29%)	26(25%)	82(21%)
Dentures had been repaired twice previously	34(12%)	20(19%)	54(18%)
Dentures had been repaired three times or more previously	43(19%)	14(13%)	57(19%)
Total of repair	225	105	330