

## Causes and types of complete denture fracture

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### Abstract

**Background and objectives:** determine the causes and types of complete denture fractures.

**Methods:** The study was performed in the Hawler medical university, college of Dentistry Department of Prosthodontics. The number of fractured complete denture collected was 290 from patients aged 35-80 years of both genders. The (causes of denture fracture, the type of fracture and the history of previous recurrent fractures) were recorded.

**Results:** : The main cause of denture fracture was poor fitting (40%), followed by poor occlusal relation (21%). Midline fracture was the commonest type of fracture (59%). From the study (51%) of the dentures had previously been repaired once or more. The ratio of lower to upper complete denture fractures was approximately 3:1; most of the fractured dentures (56%) were those of males.

**Conclusion:** The causes of the fracture were divided into material factors and clinical/ technical factors. Denture fractures can be reduced by following prosthodontic principles, analyzing proper fit, eliminating occlusal interferences and using high impact polymers or metal reinforced.

**Key words:** Acrylic resin, Complete denture fracture, Prosthodontics.

### Introduction

The material most commonly used for the fabrication of dentures is the acrylic resin, poly methyl methacrylate (PMMA). This material is not ideal in every respect and it is the combination of properties 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.<sup>1</sup> This is reflected in the unresolved problem of denture fracture

and the accompanying costs to effect repair<sup>2</sup>. Despite advances in dental technology, it can be seen that the fracture of acrylic resin dentures remains a significant problem and the number of denture fractures has not decreased. Denture fracture is usually mechanical or accidental.<sup>3</sup> Fractures in dentures result from two different types of forces, namely, flexural fatigue and impact.<sup>4</sup> Mechanical causes are related to faulty design, faulty fabrication and/ or poor materials choice.<sup>2</sup> Any factor that exacerbates deformation of the base or alters its stress distribution will predispose the denture to fracture.<sup>3,5</sup> Fracture may be due to a multiplicity of factors rather than the denture base material itself and these factors have been discussed in

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detail.<sup>6</sup> For example, any factor which increases the deformation of a denture base;<sup>7,8</sup> additional factors which form areas of stress concentration such as a large frenal notch;<sup>9</sup> dentures with poor clinical design thin or under-extended flanges; poorly fitting dentures or a lack of adequate relief; dentures with a wedged or locked occlusion; and dentures which have been previously repaired.<sup>10</sup> The ultimate goal of denture repair is to attain the original shape and strength of the denture with minimum cost and time. Several techniques and materials have been used to repair fractured dentures. Broken acrylic resin dentures are repaired with autopolymerizing acrylic resin, heat-curing acrylic resin and recently, with visible light-cured resin. Autopolymerizing resin repairs provide a rapid and economic convenience to patients.<sup>11</sup> Unfortunately, the repaired units may lose some of their original transverse strength. Furthermore, fracture of repaired dentures often occurs at the junction of old and new materials rather than through the center of repair.<sup>12</sup>

### Methods

The study was performed in the Hawler Medical University, College of Dentistry Department of Prosthodontics from 290 complete denture patients who attended the college for the repair of their fractured dentures. The following data were recorded :

1. Age and gender of the patients
2. Age of the denture at time of fracture
3. Reason for the fracture, according to history, given by the patient and clinical analysis of the clinician.
4. Site of the fracture
5. Previous or recurrent fracture.

A thorough history of the fracture was taken from the patient and the repaired denture was examined extra orally and intra orally and assessed for retention, stability, occlusal errors, etc by the clinician. The denture repair procedure was done by using a conventional method with autopolymerizing

acrylic resin. The evaluation of the repaired dentures were done by the same clinician. The collected data was analyzed by using SPSS, chi square test was used and the result was considered statistically significant when probability was less than 0.05.

### Results

The obtained data revealed that ratio of lower to upper denture was approximately 3:1 and mean age of the fractured lower denture was slightly more than that of upper denture (Table1) in which it was 9 years for the lower and about 6.7 years for the upper and generally the mean ages for the entire fractured denture in this study was about 7.3 years, the majority of the fractured complete denture was that of males (56%). Among these 290 fractures complete denture there was 16 cases present with recurrent fractured denture.

**Table 1:** Relation of the number of fractured denture to age of the denture.

Denture age–years	Number of denture
0-2	43 %15
3-5	93 %32
6-8	70 %24
8-11	35 %12
12-14	32 %11
More than 15	17 %6
<b>Total</b>	<b>290</b>

The most common type of fracture was midline fracture 171 (59%), more in upper denture 111 (65%) and those of lower midline fracture was only 60 (25%). There was a significant difference observed between the site of fracture of upper complete denture and lower complete denture when p. value set at  $p < 0.001$  (Table 2).

**Table 2:** Site of fracture.

Site of fracture	Upper denture	Lower denture	Upper & lower denture
Midline fracture	93 %58	78 %60	171 %59
Labial flange (between central and lateral)	21 %13	12 %9	33 %12
Canine area	19 %12	37 %28	56 %18
Premolar area	8 %5	2 %2	10 %4
Tuberosity and retromolar pad area	13 %8	1 %1	14 %5
Other areas	6 %4	-	6 %2
<b>Total</b>	160	130	290

Regarding the main causes of fractured complete denture the results showed a difference between that of upper and lower denture in which in upper dentures the poor denture fit was the main cause 124 (40%), poor occlusal relation was the second cause of fracture in upper denture 61 (21%) but it was the third causative factor

In the lower denture fracture 31 (10%) while accidental dropping was the main cause in the lower dentures 96 (33%), followed by poor lower denture fit 84 (29%), there was a significantly high difference between the causes of fractures in upper and lower dentures when  $p < 0.001$  (table 3).

**Table 3:** Causes of fracture.

Cause	Upper denture	Lower denture	Upper and lower denture
Poor denture fit	67 %42	40 %31	107 %37
Poor occlusion	34 %21	24 %9	58 %20
Acrylic denture base defect (porosity-scratches)	24 %15	13 %10	37 %13
Material breakdown ( fatigue )	21 %13	4 %3	25 %8
Incorrect setting of the teeth on ridge	6 %4	2 %2	8 %3
Accidents (denture dropping)	8 %5	47 %36	55 %19
<b>Total</b>	160	130	290

Less than one half 139 (48%) of repaired dentures had been repaired for the first time, and the remainder 151 (52%) had previously been repaired once or more (table4). There was a difference in the incidence between upper and lower

denture that had been repaired for the first time, but statistical analysis of the data showed that no significant difference was found between the repetition of fractures in upper in and lower dentures.

**Table 4:** Repetition of fractures in upper and lower dentures.

Repetition of denture fracture	Upper denture	Lower denture	Both upper and lower
Denture repair for first time	69 %43	70 %54	139 %48
Denture repaired once previously	27 %17	34 %26	61 %21
Denture repaired twice	24 %15	16 %12	40 %14
Denture repaired three times or more	40 %25	10 %8	50 %17
<b>Total</b>	160	130	290

## Discussion

This study revealed that poor denture fit was the main cause of fractured denture especially in the upper it was the prime cause of denture fracture, such dentures flex in mouth during function around the midline and due to repeated small loadings during mastication lead to fatigue fracture. This result agrees with previous studies <sup>3, 13, 14</sup>. The second cause of fracture in this study was poor occlusion which was found in 58 (20%) dentures due to heavy or uneven masticatory loads, specially when the fractured dentures opposed by natural, over erupted or inclined natural teeth that cause an unbalanced occlusion which lead to heavy masticatory load on the denture. This result is agreed with other performed studies <sup>13, 14</sup>. Other causes of fracture was found to be related to acrylic denture base material such as poor denture base design, inadequate thickness and defects such as

porosities, voids inside the material, deep scratches, as well as acrylic denture base processing stresses which contributed approximately to 37 (16%) dentures fracture. This finding agrees with the result of other studies <sup>3, 13, 14</sup> which showed that sharp changes in contour, pin holes, inclusions and deep scratches may all cause stress intensification and will predispose denture to fracture. In this study there was an agreement with <sup>13-17</sup> studies performed by another authors which showed that 63% of dentures had broken within 3 years of their provision because in the present study the majority of denture fracture occur after the third year to the fifth years of its use 93 ( 32%) and this may be due to breakdown of the material with age and this represents fatigue phenomenon. Therefore fracture of the denture base in situ often occurs by a fatigue mechanism in which relatively small flexural stresses, over a period of time,

eventually lead to the formation of a small crack which propagates through the denture, resulting in fracture<sup>18</sup>. The ratio of upper to lower complete denture fracture was about 3:1, and the majority of these fractures were of males, this may be due to the fact that the upper denture base has greater bulk in comparison to the lower denture base. Regarding the site of fracture it was showed that the majority of fractures were the midline fracture 171 (59%), Mid-line fracture results from cyclic deformation of the base during function, and this finding was consistent with other studies<sup>2,3,13-17</sup>. Although repairing fracture dentures with autopolymerizing resin is an economic and rapid method but the repaired denture will usually lose about 40%-60% of their transverse strength<sup>3</sup>. That is why many repaired dentures will be re fractured, so in the present study the majority of repaired dentures were previously repaired once or more 139 (48%), which had been agree with the results of other studies<sup>14,17,19</sup> which showed that 56% of total fractures had previously been repaired, 6% of them had been repaired three times or more.

### Conclusion

1. Denture fractures can be reduced by proper design and following definite prosthodontic principles in denture construction particularly during laboratory stages.
2. Eliminating occlusal interferences and establishing balanced occlusion.
3. Using high impact polymers, metal reinforcements, and glass fibers to reduce the acrylic resin fracture problems.

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