

**INCIDENCE AND CAUSES OF FRACTURE OF ACRYLIC RESIN COMPLETE DENTURE**Sampa Ray (Bhattacharya)<sup>1</sup>, Pradip Kumar Ray<sup>2</sup>, Manabendra Makhal<sup>3</sup>, Saibal Kumar Sen<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: CONTEXT (BACKGROUND):** Replacement of missing teeth and the associated structures are done with the help of artificial prosthesis. Acrylic resin, by virtue of its excellent properties is widely used as a material of choice for fabrication of denture base. In spite of its higher esthetic quality, tissue compatibility and ease of manipulation, it has an inherent deficiency of proneness to fracture. **AIMS:** The present study was being undertaken to find out the incidence of fracture of acrylic resin base of complete denture and analyze the cause, so that suitable remedial measures might be suggested to reduce the frequency of denture fracture. **SETTINGS AND DESIGN:** The present study was conducted over a period of 18 months in the Prosthetic Department of Dr R Ahmed Dental College & Hospital, Kolkata. **METHODS AND MATERIAL:** The 81 reported fracture cases out of 646 complete dentures were selected for this study. Formally consent followed by detailed history was taken. After intra-oral and physical examination, the dentures were repaired following text book recommended procedure using cold cure acrylic resin and prepared for last phase of survey, which was the intra oral examination like adaptation, retention and stability of the repaired dentures in the second visit of the patients. **STATISTICAL ANALYSIS:** The data were subjected to SPSS, version 16, and statistically analyzed using cross tab. **RESULTS:** In the present survey, 81 cases of complete denture fractures have been reported within the survey period. **CONCLUSIONS:** It appears from the present study, the rate of lower complete denture fracture is more common than upper complete denture fracture.

**KEYWORDS:** Midline-fracture, Occlusal Prematurity, Porosity, Frenectomy.

**INTRODUCTION:** Artificial replacement of human teeth had occupied an important role in the history of human civilization. From time immemorial, it has been observed that various types of materials like wood, bone, ivory, precious and semi-precious metal and alloys have been used as denture material. Also porcelain and vulcanite rubber were used for artificial teeth and denture base at different times.<sup>1</sup> Acrylic resin, which came into market in 1950s, was widely accepted as denture base material, because of its excellent "e" properties like good esthetic value, ease of manipulation, ease of repair and also economic.<sup>2</sup> Since then it is still dominating the field of Prosthetic Dentistry. Subsequently many other materials like valplast (Flexi-denture) came in the market but could not compete with acrylic resin so far, because repair, relining and adjustment of dentures with other materials is a difficult proposition or absolutely impossible.<sup>3</sup> Furthermore, acrylic teeth do not get chemically bonded to flexi-denture materials and in case of breakage, it is difficult to replace. Polishability of the flexi material is also compromised. Acrylic resin is therefore still the material of choice for artificial denture, but its proneness to fracture deserves special attention to prevent and rectify it.

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The most common causes of denture fracture may be either extra-oral cause like fall from patient's hand to the hard ground surface or inside the mouth during function.<sup>4</sup> One has to depend mostly upon the users' version for the cause of the denture fracture. Inside the mouth, fracture can happen for various reasons like improper occlusion, placement of artificial teeth in the buccal slope of the ridge or against the palate, pressure from opposing natural teeth, poor retention and stability, prolonged use causing wear of artificial teeth and re-sorption of residual ridge, presence of high frenal attachments, prominent mid palatine suture, palatal or lingual torus, hard or soft tissue undercut, etc.<sup>4,5</sup>

Defects in the denture may also be created during laboratory procedure. This may include thin denture base, placing the artificial teeth in the buccal slope of the ridge, incorporation of metal strengtheners, inclusions like plaster or air bubbles within the material, porosity, deep scratches which act as a stress raiser and predispose the denture to fracture.<sup>4,5,6</sup>

The present study was undertaken with the objective to determine the incidence and causes of fracture, so that suitable remedial measures can be adopted to reduce the incidence of such occurrences.

**MATERIALS AND METHODS:** The present study was conducted over a period of 18 months in the Prosthetic Department of Dr. R. Ahmed Dental College & Hospital, Kolkata. Within this survey period, the total number of 646 complete dentures was constructed from commonly available acrylic resin, out of which 81 patients (both male & female) had reported for repair of their denture. These 81 first time reported fracture cases were selected for this study.

Formally detailed history was taken, which includes the information about (i) the duration of use of the appliance, (ii) how the fracture took place, (iii) daily use and (iv) general complaint about the denture.

The intra-oral examination of the patient was conducted in respect of the form of the arch, hard palate, the depth of the palatal vault, degree of ridge resorption, ridge relation, the prominence of mid palatal suture, attachment of the frenum, presence of soft tissue on the ridge, presence of undercut, presence of natural teeth on opposing arch, were performed with history taking. Physical examination of the fractured denture also includes the number and site of the fracture line, depth of the incisal notch, and arrangement of artificial teeth, occlusal wear, and thickness of denture base, presence of porosity / crazing.

After physical examination, the dentures were repaired following text book recommended procedure using cold cure acrylic resin and prepared for last phase of survey, which was the intra oral examination like adaptation, retention and stability of the repaired dentures in the second visit of the patients. After thorough examination in regard to the presence of premature contact, amount of over jet, overbite, freeway space, etc., the repaired dentures were delivered. Data obtained were tabulated and analyzed for result.

**RESULTS AND OBSERVATIONS:** Total number of Complete dentures constructed and delivered within the 18 months of study period was 646 and fractured complete dentures reported within this period was 81, out of which upper was 33 (40.8 %) and lower was 48 (59.2 %) (Fig-1). The incidence of complete denture fracture according to gender and thickness of denture base is shown in pie chart (Fig-2 & 3). In our present study, it was also noted that, in case of complete denture fracture, 57 cases (70.37 %) had midline fracture, 15 cases (18.52 %) had fracture elsewhere in denture and in 9 cases

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(11.11 %) teeth were de-bonded from the base. When the presence of porosity & crazing causes fracture of denture, we had seen that in case of complete denture, these were present in 29 cases (35.80%) & absent in 52 cases (64.20%). If we consider the role of opposing natural teeth, we had seen from our present study, out of 81 cases of complete denture fracture, only 27 cases (33.33%) opposed natural dentition. We had also seen an important role of arrangement of artificial teeth as cause of denture fracture. In our study, in 26 cases (32.10%), artificial teeth were set on ridge and in 55 cases (67.90%), teeth are buccal to ridge. When retention & stability were concerned, out of 81 fractured complete dentures, in 66 cases, these were poor. Occlusal prematurity also influences denture fracture. In our study, we had seen that in complete denture fracture cases, out of 81 cases, occlusal prematurity was present in 59 cases.

**DISCUSSION:** In the past, similar surveys had been conducted by Hargreaves (1969),<sup>7</sup> Beyli (1981),<sup>4</sup> Todorov (1988),<sup>8</sup> Broz and associates (1991)<sup>9</sup> and Darbar, Hugget and Harrison (1994).<sup>10</sup> Theoretically, an edentulous patient could not fracture a complete denture because of relatively high static strength of denture construction and because of low occlusal biting force with removable dentures.<sup>11,12</sup> Fracture of a denture in the mouth by a single bite is very improbable, because the load required to cause fracture ranged from 180-800 lb,<sup>13</sup> much higher than that which a denture wearer appears to be capable to produce during function, i.e 13-16 lb.<sup>14,15</sup>

Denture fracture is usually mechanical or accidental.<sup>4,7,16,17</sup> Mechanical causes are related to faulty design, faulty fabrication and, or poor materials choice.<sup>10,13,16</sup> Furthermore the fracture of the denture base 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>

To minimize the possibility of fracture/re-fracture, different methods like use of E-glass fiber reinforced PMMA,<sup>19,20</sup> visible light polymerized resin,<sup>21</sup> metal reinforced resin<sup>22</sup> are practiced now a days. Even, Canada Dental Association recently tried quick setting self-curing denture repair resin based on diacrylate, available in the market as “Qu resin Rosa”.

In the present study, the analysis of fractures of the 81 reported acrylic complete dentures were performed, which was 12.53 % of total 646 delivered complete dentures during survey period and out of total reported cases, 40.8 % was upper & 59.2 % was lower one. Smith (1961)<sup>13</sup> found a slight above average fracture incidence for males and according to him, the higher masticatory or gliding movement forces are contributory factors and this is particularly true in short term failure (less than 1.5 years). Broz et al (1991)<sup>9</sup> also found male predominance (71.5%) in complete denture fracture, which is very much similar with the present study.

Sharry (1974)<sup>23</sup> has said that fractures may be due to accidentally dropping the denture, when they are out of mouth or during mastication of food. In order to prevent lower complete denture fracture, the patients particularly the males should be instructed specially regarding cleaning procedure of the denture to prevent fall and subsequent breakage of dentures. Setting the posterior teeth on the ridge and in balanced occlusion may reduce the frequency of fracture of upper complete denture.

Smith (1961)<sup>13</sup> reported that the midline fracture of the maxillary complete denture usually occur after 3 years in clinical use, which is very much similar with the present study. Smith<sup>13</sup> also described that the incisal notch as “notch effect” to the denture & it appears from the present study that the depth of the incisal notch has a significant role in fracture of the upper complete denture.

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Winkler (1996)<sup>24</sup> said that the most common denture fracture are those along the mandibular and maxillary midline. Sharry (1974)<sup>23</sup> also confirmed this view. Lambrecht (1962)<sup>5</sup> suggested that relief in the median palatal suture area should be given to prevent midline fracture, as because it acts as fulcrum as the denture flex during mastication.

Farmer (1983)<sup>25</sup> found that many denture fractures are a direct result of malocclusion in combination with a maxillary denture with a deep labial notch, resulting from a high frenal attachment. Frenectomy in cases with high labial frenum can be advised with provision of immediate denture to prevent recurrence of union of the frenum after surgery.

In our present study, 33% of complete dentures were opposed by natural teeth on opposing arch.

Hargreaves (1969)<sup>7</sup> in his survey found that in a considerable number of denture fracture cases, it was opposed by natural dentition. Recontouring the existing natural teeth to produce an uniform occlusal plane and establishment of balanced occlusion can reduce the incidence to some extent.

Boucher (1990)<sup>6</sup> has said that posterior teeth placed buccal to ridge can cause a denture to tip when pressure is applied on the tooth in that bad leverage position. Lambrecht (1962)<sup>5</sup> in a study found that in most maxillary dentures, the posterior teeth were set over buccal slope of the residual alveolar ridge. In our present study, similar were seen among the reported fractured denture cases. Artificial teeth should be precisely set on the crest of the residual alveolar ridge or slightly lingual to it and a balanced occlusion should be established to reduce the frequency of denture failure.

In our present study, it was found that in 81.48% of complete denture, retention and stability was poor. This percentage seems to be very significant. Beyli (1981)<sup>4</sup> in a survey of fractured dentures found that the most common cause of denture fracture is poor retention and lack of balanced occlusion.

In the present study, it was found that in 72.84% of complete denture, occlusal prematurity was present. Boucher (1990)<sup>6</sup> stated that breakage of individual teeth as well as entire denture, is often caused by a change in occlusal relation and remounting and regrinding is essential to prevent breakage from occurring again.

In our present study, it was found that in 48.15% of complete denture cases, either hard or soft tissue undercut was present. Schneider (1985)<sup>11</sup> observed that soft or hard tissue undercuts that are relieved in the base to facilitate the path of insertion and removal can result in a thin denture base that is susceptible to fracture under function.

In the present study, in 35.80% of complete denture, porosity was present. Beyli (1981)<sup>4</sup> stated that fracture is the result of the initiation and propagation of a crack, which might be due to different causes, which includes porosity, presence of air bubble inside the material etc.<sup>26,27</sup>

**CONCLUSION:** Mouth preparation should be given primary importance. Frenectomy should be done in high frenal attachments and relief should be given on prominent mid palatal suture. An uniform occlusal plane should be established either by grinding, recontouring or crowning of the existing natural teeth. Posterior teeth should be placed on the residual ridge and in balanced occlusion. Occlusal prematurities should be eliminated in both complete and partial denture. Dentures should be made of greater permissible thickness to make it more rigid. Proper care should be taken during laboratory procedure to prevent porosity in the denture. To minimize the possibility of fracture/re-

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fracture, E-glass fiber reinforced PMMA, visible light polymerized resin, metal reinforced resin may be used.

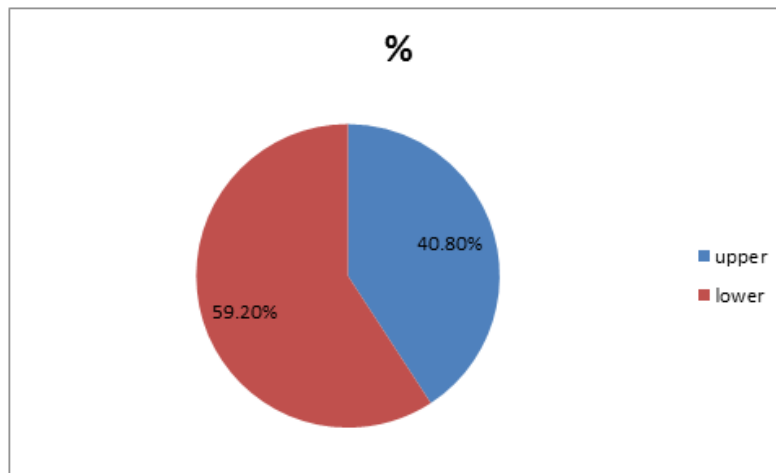
Last, but not the least, proper instruction should be given to the patients about the careful handling of the denture, as many of them broke due to sudden fall. Patients should clean the denture within a bowl filled with water.

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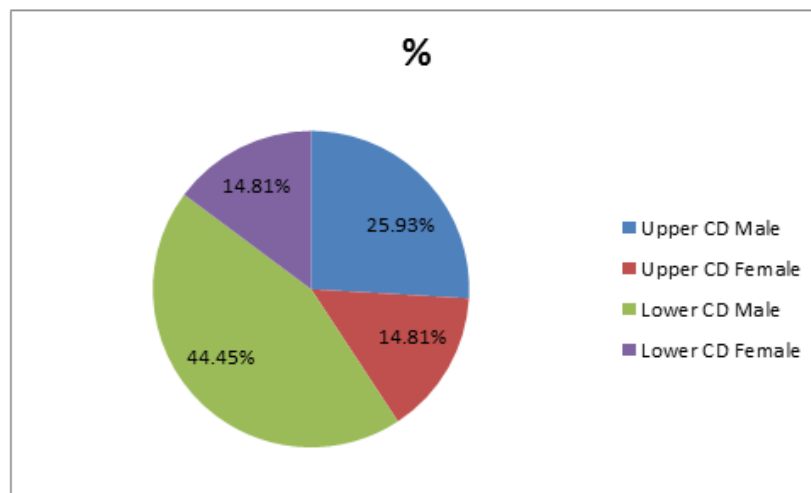
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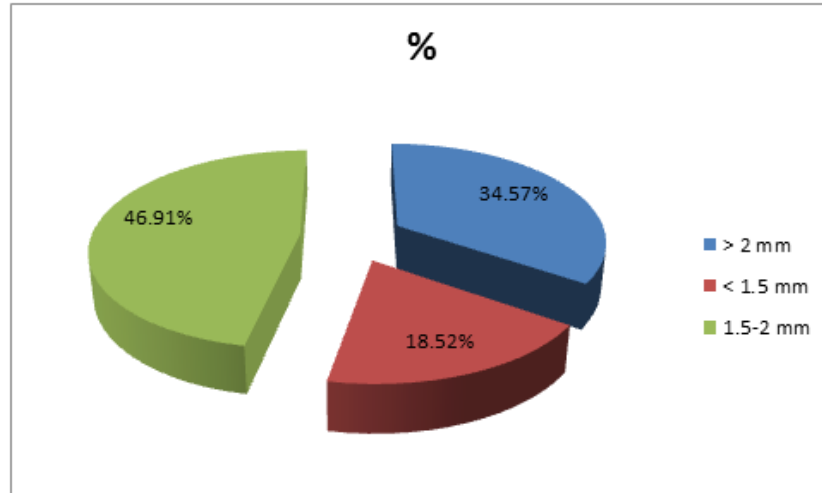
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**Fig. 1: Pie chart showing the percentage of upper and lower complete denture fracture**



**Fig. 2: Pie chart showing incidence of complete denture fracture according to gender**



**Fig. 3: Pie chart showing distribution of complete denture fracture according to thickness of denture base**

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