

# Complete denture fracture – A proposed classification system and its incidence in National Capital Region population: A survey

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## Abstract

**Aim:** The complete denture fracture of denture may ruin the routine life of an edentulous patient. The aim of the present study was to propose and evaluate a new classification system for denture fractures.

**Settings and Design:** Cross sectional -Survey.

**Materials and Methods:** Ten dental laboratories in Delhi and the National Capital Region participated in the study for 2 years. The accurate assessment of fractured dentures received in the laboratories for repairs was done. A questionnaire with complete information along with photographs was used to classify the denture fracture.

**Statistical Analysis Used:** Percentage (proportion) statistical test.

**Results:** Out of 620 dentures, 164 (94 maxillary and 70 mandibular) were found with previous repair, soft liners, metal frame, or wire reinforcements which were excluded from the study. In the present study, 456 dentures were considered (256 maxillary and 200 mandibular). Class I fracture (midline) was the most common in both maxillary and mandibular dentures (46.87% in maxillary and 61% in mandibular) with high significance ( $P < 0.001$ ). Class II and Class V were the second most common pattern of fracture in mandibular and maxillary dentures, respectively. There was no single case of Class III fracture for the mandibular dentures, and Class IV was the least common among the maxillary dentures.

**Conclusions:** This study encourages further clinical studies for validation and reliability evaluation of proposed new classification system.

**Keywords:** Denture fracture, denture repair, midline fracture, tooth debonding

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## INTRODUCTION

The most common prosthesis offered to edentulous people worldwide is complete denture.<sup>[1]</sup> The material most commonly used for the fabrication of dentures is the acrylic

resin, polymethyl methacrylate. Despite its popularity, one of the resolved complications associated with it is denture fracture.<sup>[2]</sup> The fracture of denture may cripple the day-to-day routine life of a complete denture patient.

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The denture fracture may occur due to faults in denture fabrication, poor fit and lack of balanced occlusion, and low resistance to fracture of acrylic resin.<sup>[3,4]</sup> Fractures in dentures may either result from flexural fatigue or impact. Flexural fatigue occurs after repeated flexing of a material while the catastrophic failure or impact failure demonstrates the mechanical limitation of the material.<sup>[5]</sup> A common site of fracture is on an anteroposterior line that coincides with the labial notch of either maxillary or mandibular complete denture. This is often a result of flexural fatigue. The alveolar resorption of the maxilla provokes flexure of the left and right halves of the denture with a fulcrum along midline of the palate.<sup>[6]</sup> Besides, other sites such as denture border may be involved.<sup>[7]</sup> The failure of artificial teeth includes fractures and detachments.<sup>[3]</sup> Tooth debonding mainly occurs as a result of faulty laboratory technique as contaminated bond surfaces or improper curing cycle.<sup>[7]</sup> Denture tooth fracture is usually the result of improper handling out of the mouth.<sup>[4,8]</sup> Despite the high frequency of denture fracture, there is surprisingly little discussion of the subject in the literature. The existing literature does not state any standard classification system of denture fracture; hence, a classification system of denture fracture based on the site and pattern of fracture has been proposed. Previous studies have not mentioned denture fracture sites or zones with any standard nomenclature or description.<sup>[9,10]</sup> The proposed classification system will be a helpful tool for assessment of its cause, ease of communication with dental technician and other professionals, and planning the kind of repair needed.

### Proposed classification system

The aim of the present study was to study the types of fractures and to evaluate the new classification system.

- Class I: The fracture line passes through the midline between the central incisors extending to the posterior extension. The fractured fragments may or may not be completely separated [Figures 1 and 2]
- Class II: The fracture line passes through other than midline in a diagonal direction extending to the posterior extension. The fractured fragments may or may not be completely separated [Figure 3]
- Class III: The fracture line is moon shape passing through the labial or buccal flange. The fractured fragment may or may not be separated [Figure 4]
- Class IV: The fracture line passes through dentoalveolar structure of the denture, involving two or more teeth. In this denture, base continuity is preserved [Figure 5]
- Class V: The fracture of a part of artificial tooth or separation of a single tooth from denture [Figures 6 and 7].



Figure 1: Class I mandibular denture fracture



Figure 2: Class I maxillary denture fracture



Figure 3: Class II mandibular denture fracture

### MATERIALS AND METHODS

The study was approved by institutional review board. Ten dental laboratories in Delhi and the National Capital Region

agreed to participate in the study. A questionnaire<sup>[9]</sup> [Table 1] was then submitted to these laboratories for each damaged denture received for repairs. One certified dental technician from each laboratory was authorized to evaluate, complete the questionnaire, and click the photograph for each fractured denture. A pilot study was carried out for 1 week under the supervision of the authors for accurate assessment of fractured dentures and completion of the questionnaire, and photographs were also evaluated. The dentures made with metal denture base, with porcelain teeth and dentures with previous repairs, relines, wires, or mesh, were excluded from the study. The data were collected for a period of 2 years. The type of fracture marked was verified by the photographs received, respectively. The collected data were statistically analyzed.

### RESULTS

During the 2-year period, 620 questionnaires were collected concerning complete denture fracture. Three hundred and fifty maxillary dentures compared to 270 mandibular dentures were reported. Out of these, 164 (94 maxillary and 70 mandibular) were found with previous repair, soft liners, metal frame, or wire reinforcements which were excluded from

the study. In the present study, 456 dentures were considered; out of these, 256 were maxillary and 200 were mandibular. The sample size was in correlation with previous studies.<sup>[9]</sup>

**Table 1: Questionnaire**

1. Type of complete denture
Maxillary
Mandibular
2. Denture base material
Acrylic
Metal
3. Artificial teeth
Acrylic
Porcelain
4. Type of fracture (proposed classification)
Class I
Class II
Class III
Class IV
Class V
5. Any sign of previous repair
Yes
No
6. Number of fracture lines
1
>1



**Figure 4:** Class III maxillary denture fracture



**Figure 5:** Class IV maxillary denture fracture



**Figure 6:** Class V maxillary denture fracture



**Figure 7:** Class V mandibular denture fracture

Class I fracture (midline) was the most common in both maxillary and mandibular dentures with a percentage of 46.87% in maxillary [Table 2 and Graph 1] and 61% in mandibular fractured dentures ( $P < 0.001$ ) [Table 3 and Graph 2]. It was observed that Class II was the second most common pattern of fracture in mandibular dentures with 24% of total lower dentures ( $P < 0.001$ ) followed by Class V fractures [Table 3 and Graph 2].

For the maxillary dentures, Class V fracture was the second most common fracture found (28.12%) followed by Class III fractures (16.40%) [Table 2 and Graph 1].

There was no single case of Class III fracture for the mandibular dentures, and Class IV fracture also occurred relatively infrequently (only 3.5%) [Table 3 and Graph 2]. The percentage of Class II (5.4%) and IV fractures (3.12%)

**Table 2: Distribution of maxillary denture fracture according to class**

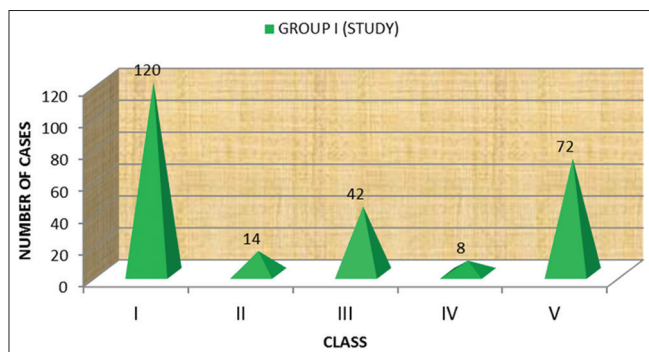
Class	Number of dentures found	Percentage out of 256	Percentage out of total 456
I	120	46.87	26.31
II	14	5.46	3.07
III	42	16.40	9.21
IV	8	3.12	1.75
V	72	28.12	15.78

Total denture fracture  $n=456$ ; maxillary denture  $n=256$ . P: I versus II  $<0.001$ ; I versus III  $<0.001$ ; I versus IV  $<0.001$ ; I versus V  $<0.001$ ; II versus III  $<0.001$ ; II versus IV 0.191 NS ( $>0.05$ ); II versus V  $<0.001$ ; III versus IV  $<0.001$ ; III versus V  $<0.001$ ; IV versus V  $<0.001$ . NS: Not significant

**Table 3: Distribution of mandibular denture fracture according to class**

Class	$n$	Percentage out of 200	Percentage out of total 456
I	122	61	26.75
II	48	24	10.52
III	0	0	0
IV	7	3.5	1.53
V	23	11.5	5.04

Total denture fracture  $n=456$ ; mandibular denture  $n=200$ . P: I versus II  $<0.001$ ; I versus III  $<0.001$ ; I versus IV  $<0.001$ ; I versus V  $<0.001$ ; II versus III  $<0.001$ ; II versus IV  $<0.001$ ; II versus V  $<0.001$ ; III versus IV  $<0.001$ ; III versus V  $<0.001$ ; IV versus V  $<0.001$



**Graph 1: Distribution of maxillary denture fracture according to class**

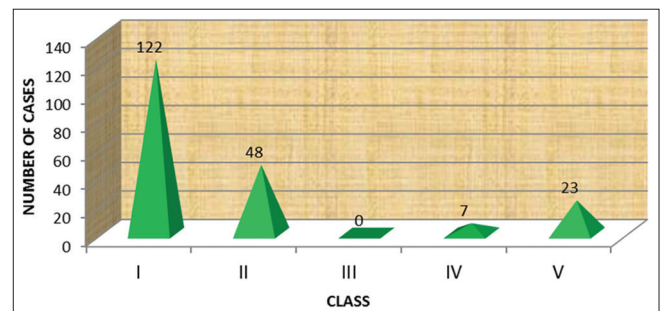
was also significantly less for the maxillary dentures reported [Table 2 and Graph 1].

**DISCUSSION**

The present study reveals that of 620 dentures reported for repair, 164 (26%) had been previously repaired which is comparable to that of study by Darbar *et al.*<sup>[2]</sup> These were excluded from the study. The remaining 456 dentures and questionnaires were evaluated according to the proposed classification system.

In this study, Class I was the most common fracture found (46.87% in maxillary and 61% in mandibular dentures) which is in agreement with the previous studies.<sup>[2,9,11]</sup> Midline fracture in the upper denture has been related to the cyclic deformation of the base during function.<sup>[9]</sup> Fracture usually originates from the labial notch area which should be rounded than a sharp one.<sup>[12]</sup> The less surface area and thinness in the middle part of the lower denture are responsible for the fracture. Besides, accidental dropping of denture, patient negligence during insertion, and removal and cleaning of denture are among the major causative factors for lower denture fracture.<sup>[11]</sup> The study revealed near about 24% of Class II fractures of the lower dentures which is comparable to the report by Khalid.<sup>[10]</sup> The use of strengtheners such as metal frame or wire in denture bases has found to reduce denture base fracture, but it increased tooth debonding. These kinds of reinforcements hold the pieces together if fracture occurs but weakens the base creating stress concentration points, especially at tooth bonding surfaces.<sup>[13]</sup> However, the problem of acrylic resin fracture can be reduced by the use of high-impact resins.<sup>[14]</sup> Electrical glass partial fiber reinforcement has significantly proved to enhance the mechanical strength of denture bases.<sup>[15]</sup>

The prevalence of broken and debonded teeth (Class V) was significantly more in the maxilla with 28.12% of total upper dentures. Similar results were found by Zisis *et al.*<sup>[9]</sup> Vallittu *et al.* also found a high prevalence of denture



**Graph 2: Distribution of mandibular denture fracture according to class**

fracture resulting from teeth debonding (26%).<sup>[3]</sup> This type of failure may be attributed to lesser ridge lap surface areas available for bonding, polymerization of acrylic resin, or wax remaining between the surface of artificial teeth and denture base acrylic resin.<sup>[7,16]</sup>

According to the proposed classification system, Class III fracture presents a fracture line in moon shape passing through the labial or buccal flange of complete denture. Our results showed that 16.4% of maxillary dentures presented with this which was in agreement with previous studies. This has been termed as border or flange fractures.<sup>[17]</sup> On the contrary, no single case was found of Class III fracture for mandibular denture that can be due to short flanges and thin mandibular dentures in whole.<sup>[11]</sup>

Autopolymerizing resin has been the most popular material for repair because it allows easy handling and quick repair at low cost.<sup>[18]</sup> Among the other materials such as heat-polymerized, microwave- or light-polymerized resins, heat polymerized resins were found to be best followed by microwave.<sup>[19,20]</sup> In another study, the autopolymerized resin was found to exhibit repair strength comparable to conventional heat-cured and microwave-polymerized resin.<sup>[21]</sup> The use of cyanoacrylate adhesive in combination with microwave polymerization was found to be a good technique of repairing acrylic tooth debonding.<sup>[22]</sup>

Although this classification system clearly presented with various paths of fracture line found in maxillary and mandibular dentures, this study has certain limitations. The dentures were evaluated in laboratory without its correlation with the clinical findings as the focus of the study was on the site and pattern of the denture fracture. The other limitation was multiple fractures cannot be classified by this system because a single site or pattern can only be used to determine the classification. Further clinical studies should be conducted for proposed classification validation, reliability evaluation, and clinical correlation.

## CONCLUSIONS

1. The proposed new classification system of denture fracture based on the site and pattern of fracture can be a better tool for communication, categorize the cause, and guide for the methods of repair
2. Class I fracture was the most frequent for both types of dentures
3. The study showed that Class V was the second most common fracture in maxillary and Class II fracture in mandibular dentures

4. No single case of Class III fracture was found in mandibular dentures, and Class IV was the least common in maxillary dentures (3.5%).

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## Conflicts of interest

There are no conflicts of interest.

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