

# Correlation of Frequent Complete Denture Fabrication Errors with patients' Demographic Factors, Stages of Complete Denture Fabrication and PDI

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## ABSTRACT

**Aim:** To determine the frequency of errors during stages of complete denture fabrication by undergraduate BDS students and find out their correlation with patient age, gender and Prosthodontic Diagnostic Index (PDI).

**Study Design:** Cross sectional Observational study

**Place and duration:** Prosthodontic Dept. of Lahore Medical & Dental College, Lahore, from February 2<sup>nd</sup> 2024 till May 2<sup>nd</sup> 2024.

**Methodology:** A total of 150 complete dentures made by 75 undergraduate students of both gender; working in the department were selected. Students clinical work of denture fabrication was assessed at five stages of denture making and each procedure was clinically assessed at its 4 main steps i.e.; primary impression (impression tray selection, impression mixing, tray placements, impression details), Secondary impression (tray preparation, peripheral boarder molding, wash impression, post dam area recording), Jaw relations (occlusal rims adjustments, establish occlusal plane, vertical relations, centric relation), Tooth setup (canine relation, molar relation, plane of occlusion, ridge relation), Trial and final insertion (esthetics, comfort, finishing and polishing, spot grinding).

**Results:** Maximum of four errors were present at the teeth setup stage of complete denture making 72.7%, followed by jaw relation 29.3%. Maximum number of three errors were found at jaw relation stage 69; 46.0% followed by set up of teeth stage; 41; 27.3%. Maximum of two errors were frequently found at trial/ insertion stage 56.0%, followed by secondary impression; 64.7% and primary impression stage 38.0%. Denture fabrication errors at primary impression, secondary impression and jaw relation stages were significantly associated with PDI of the patient;  $p < 0.05$ , whereas insignificant results were seen with teeth setup and trial/insertion stages. Correlation with respect to gender was statistically insignificant with errors found in all 5 stages of denture fabrication. The correlation of age and errors of primary impression, secondary impression and jaw relation was significant;  $p < 0.05$  however no correlation with teeth setup and trial/insertion stages was present.

**Conclusion:** It can be concluded that the most frequent errors made by undergraduate BDS students were at the stages of artificial denture teeth set up and recording maxillomandibular jaw relations and increase in age and PDI complicates the denture fabrication.

**Keywords:** Complete dentures, Errors, Gender, Prosthodontic Diagnostic Index, Undergraduates.

## INTRODUCTION

Complete denture is the most economical yet effective prosthesis of choice for a patient with complete loss of teeth and tissue<sup>1</sup>. A well fabricated complete denture prosthesis can only be made if clinician has extensive theoretical knowledge and good clinical hand<sup>1</sup>. Various steps of complete denture fabrication include taking primary impression, secondary impression, jaw relations, denture trial and final denture insertion<sup>1,2</sup>. Patient acceptance of denture is highly dependent on the accuracy of each step and procedure properly performed. Completing various steps of denture fabrication with accuracy is a big challenge as errors at any step will undermine the efficiency of a denture in performing oral functions<sup>3</sup>. Furthermore, these errors can affect in deleterious effects to the mucosa and hard tissues of the oral cavity. Denture qualities like denture retention, stability, support, esthetics and functions (swallowing, speech and chewing) are directly affected by the errors of denture fabrication<sup>1,4</sup>.

It has been documented that a denture patient complains when there is actually a real design fault in a denture construction<sup>5</sup>. The commonest complaints related to complete dentures are related to traumatic injuries of dentures, failure of retention, food lodgment under the dentures and failure to perform certain oral functions.<sup>6</sup> In literature various studies have documented pain and discomfort as a most frequent complaint of a new denture wearer while others have reported poor denture retention, stability to be the causes of denture failure<sup>7</sup>.

The poor oral health of an edentulous patient also complicates the denture fabrication procedures. Extremely resorbed residual alveolar ridges, thin oral mucosa, lack of muscle tone, pseudo prognathism, sagging of facial muscles along with poor patient compliance are all the factors that complicate the denture fabrication procedures and directly affects the quality of a complete denture<sup>8</sup>. Prolonged edentulism period and resultant oral tissues problems demand skilled and efficient prosthodontic treatment modalities so that denture construction errors can be minimized and prevented<sup>9</sup>. The maximum problems seen in the faulty dentures of edentulous patients are directly related to errors in recording accurate vertical, horizontal jaw relationship, incorrect positioning of teeth, disturbed occlusal plane<sup>9,10</sup>.

All dental colleges include complete denture teaching and training; of BDS students in their respective curricula globally. However there have seen large variation in gaining the amount of denture fabrication experience by dental students. In order to achieve successful treatment outcomes, teaching methodology should be focused, clinical skills taught during students training period should be structured, supervised and effective.<sup>11</sup> These measures will not only boost the confidence of a dental student practicing dentistry independently after graduation but will also help him establishing quality dental practice that would be beneficial to him and to the society<sup>12</sup>.

The current study was conducted to identify the frequent complete denture fabrication faults done by BDS students. Identify most difficult stages in complete denture fabrication by undergraduate students so that more emphasis should be given on the difficult stages of complete denture fabrication during clinical demonstrations and teaching methodologies in dental colleges.

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This will not only improve the denture quality and patient acceptance but also save the time and material wastage in the department.

The objective of the current study was to determine the frequency of errors during stages of complete denture fabrication by undergraduate BDS students and find out their correlation with patient age, gender and Prosthodontic Diagnostic Index (PDI).

**METHODOLOGY**

This cross-sectional observational study was carried out in Prosthodontic Department of Lahore Medical & Dental College, Lahore. The study was conducted in a span of 7 months i.e.; February 2<sup>nd</sup> 2024 till May 2<sup>nd</sup> 2024. A total of 150 complete dentures (75 maxillary 75 mandibular complete dentures) fabricated by 75 undergraduate students of both gender; working in the department were selected via non probability consecutive sampling. The sample size was calculated by RAO Soft Epi Calculator against 5.1% patient prevalence who were equally dissatisfied with their both maxillary and mandibular dentures<sup>13</sup>, keeping margin of error 5% and 95% confidence interval. Inclusion criteria were set to include the dentures made by students of BDS 3<sup>rd</sup> year and 4<sup>th</sup> year who were working in prosthodontic department. The dentures clinically assessed by senior faculty members of the department. Patients of all ages needing conventional complete dentures were included. Exclusion criteria; all cases assessed or assisted by demonstrators, post graduates and house officers. Informed consent was taken.

Students clinical work of denture fabrication was assessed for number of errors found at five stages of denture making and each procedure was clinically assessed at its 4 main steps i.e.; primary impression ( impression tray selection, impression mixing, tray placements, impression details), Secondary impression (tray preparation, peripheral boarder molding, wash impression, post dam area recording), Jaw relations (occlusal rims adjustments, establish occlusal plane, vertical relations, centric relation), Tooth setup (canine relation, molar relation, plane of occlusion, ridge relation), Trial /final insertion (denture retention, stability, support, comfort). The difficulty level of each procedure was assessed via number of errors recorded in each procedure and Prosthodontic diagnostic index (PDI)<sup>14</sup> used to assess the complete denture patients' clinical conditions. PDI is a diagnostic criteria taking in

account following 4 features: (1) bone height of mandibular ridge, (2) maxillomandibular relationship, (3) residual ridge morphology maxilla, (4) muscle attachments. PDI class I; ideal or maximumly compromised, class II Moderately compromised, class III substantially compromised, Class 4 severely compromised.<sup>1</sup>

Data was entered and analyzed by computer software SPSS Version 26. Descriptive statistics (frequency and %age) was done for qualitative variable like gender. For quantitative variables like patients age, PDI, number of errors in all 5 clinical procedures were presented as mean and ±SD. Pearson's Chi square test was used to find out the association of number of errors of complete denture fabrication stages with patients' gender, age and PDI. Significance level was set at p<0.05.

**RESULTS**

A total of 150 complete dentures made by 75 dental undergraduates were assessed for number of errors; recorded at 4 stages of each of the 5 clinical steps of denture fabrication. 103(68.7%) were male and 47(31.3%) were female patients. Age ranged from 34 to 80 years with mean age 60.19; ±SD12.45. Moderately compromised patients' oral health according to PDI was frequently found. 70(46.7%) followed by minimally compromised 37(24.7%). Ideal oral health condition according to PDI was present in 31(20.7%) patients and severely compromised were 12(8%). Maximum of four errors were present at the teeth setup stage of complete denture making 109(72.7%), followed by jaw relation stage 53(35.3%) (Table I). Maximum number of three errors were found at jaw relation stage 69(46%) followed by set up of teeth stage; 41(27.3%). Maximum of two errors were frequently found at trial/ insertion stage 84(56%), followed by secondary impression; 97(64.7%) and primary impression stage 57(38%) (Table I). Denture fabrication errors at primary impression, secondary impression and jaw relation stages were significantly associated with PDI of the patient; p<0.05, whereas insignificant results were seen with teeth setup and trial/insertion stages (Table II). Correlation with respect to gender was statistically insignificant with errors found in all 5 stages of denture fabrication. The correlation of age and errors of primary impression, secondary impression and jaw relation was significant; p<0.05 however no correlation with teeth setup and trial/insertion stages was present (Table II).

Table I: Frequency distribution of number of procedural errors of complete dentures (n=150).

Number of errors	Fabrication stages of complete denture				
	Primary Impression%	Secondary impression%	Jaw relations%	Teeth set up%	Trial/Insertion%
One	37(24.7)	13(8.7)	1 (0.7)	0(0.0)	22(14.7)
Two	57(38.0)	97(64.7)	27(18.0)	0(0.0)	84(56.0)
Three	40(26.7)	30(20.0)	69(46.0)	41(27.3)	41(27.3)
Four	16(10.7)	10(6.7)	53(35.3)	109(72.7)	3(2.0)

Table II: Pearson Correlation of denture fabrication stages errors withPDI, gender and age (n=150).

Denture fabrication errors		PDI	Gender	Age
Primary impression errors	Pearson correlation	0.51	0.03	0.29
	Significance (2 tailed)	0.00	0.70	0.00
Secondary Impression errors	Pearson correlation	0.17	-0.03	0.26
	Significance (2 tailed)	0.03	0.73	0.00
Jaw relation errors	Pearson correlation	0.42	-0.07	0.21
	Significance (2 tailed)	0.00	0.40	0.01
Teeth setup errors	Pearson correlation	0.08	0.92	-0.11
	Significance (2 tailed)	0.34	0.26	0.17
Trial/insertion errors	Pearson correlation	0.06	0.06	0.13
	Significance (2 tailed)	0.85	0.42	0.12

Significance level was p<0.05.

**DISCUSSION**

The current study was conducted on 150 completely edentulous dentures made by 75 under graduate dental students to see the frequent errors at 5 stages of denture fabrication. In the study more male 68.7% patients were found as compare to female 31.3%.The similar findings were reported by Aamir<sup>15</sup> and Memon<sup>16</sup> in their

respective studies and the reason could be explained as a fact that females are mostly customarily homebound and do not seek treatment as compare to males. In the current study when correlated with procedural errors occurred at each step of denture fabrication insignificant results with gender was seen. In the study the mean age of the participants was 60 years and when correlated with errors made at steps of denture making it was

found that with increasing age chances of errors at primary impression, secondary impression and jaw relation stages increases. This finding could be explained on the fact that aging affects the oral tissues and complicates the denture fabrication procedures.<sup>17</sup>The percentage of moderately compromised tissues according to PDI(Prosthodontic diagnostic Index) was higher in current study and that also showed significant correlation with number of errors at these denture fabrication stages.

Edentulous mouth impressions both (primary and secondary) are the initial procedural steps of complete denture fabrication.<sup>17,18</sup> The number of errors found in these two steps were lowest in the current study. In the present study number of maximum four errors were only 10.7% and 6.7% in primary and secondary impressions. Swarthy<sup>19</sup> and coworkers conducted a study among denture students to see their perception about different step and procedure involved in complete denture making. In accordance with the result of current study they reported 68% of the students claiming that they are confident in getting good primary impression in first trial. 40 % of their students were confident about boarder molding technique of secondary impression and 66 % were aware of various materials of border molding.

To maintain craniofacial harmony dentists must establish lost vertical height of the patients' oral cavity<sup>19</sup>. Recording maxillomandibular relations and restoring lost vertical dimension is a difficult step of complete denture fabrication<sup>15</sup>. In the current study number of errors found in recording jaw relations was high. Maximum three errors 46% and four errors 35.3% were found in students conducting jaw relation. Likewise, Swarthy<sup>19</sup> and coworker reported 40% of their student confidently performing jaw relation. However, compare to other steps least confidence was seen in jaw relation. Bacali<sup>20</sup> and coworker reported less confidence regarding maxillomandibular relationship in their students. They stated that recording and determination of maxillomandibular relationship record to be a laborious stage for them because of difficulty of the procedure itself. Aamir<sup>15</sup> and coworker reported construction faults in denture patients where 14.7% had normal vertical dimension while record of incorrect vertical dimension was high i.e.; 81.7 % with high vertical and 3.6% with low vertical. Similarly in centric relation 81.2% had right centric relation and 18.8% had recorded wrong relation. Mandicos<sup>21</sup> reported 86.6%cases of incorrectly recorded jaw relations. Aghdaee<sup>22</sup> and Memon<sup>16</sup> reported 86.6%and 94%cases of incorrect vertical records,

In current study dental students found difficulty in arranging artificial teeth. When selecting and arranging artificial denture teeth; maximum errors were seen in current study where the percentage of three and four errors was high 27.3% and 72.7%. Likewise, Nikolopoulou<sup>23</sup> and coworker reported most of the procedure errors during occlusion and lack of posterior palatal seal in secondary impression. In contrast Swarthy<sup>1</sup> and coworkers reported 52%confidence found in their students when selecting correct anthropometric method of anterior teeth selection. However, in a study done by Vasanti Lagari<sup>24</sup>and coworkers only 20% students were confident about replacing missing teeth with complete denture. The difference in results could be explained by the fact that difference in teaching methodologies could affect the outcome.

The trial and insertion of complete dentures are the final stages of denture fabrication where dentures were finally assessed for their good retention, stability support and aesthetics<sup>15-18</sup>. Very few 2.0% of our undergraduates made maximum errors at this stage of denture making. Contrasting result were found in the study carried out by Aamir<sup>15</sup> and coworkers. Similarly, Bacali<sup>20</sup> and coworkers found their students more confident and reported 55.35% patient with satisfactory finishing and polishing whereas 44.7% with unsatisfactory results. Honey<sup>25</sup> and coworkers stated that students find more confidence in performing simpler procedures and in procedures in which they had maximum experience clinically and vice versa. Punya<sup>26</sup> and coworkers found

100% confidence in fabricating complete denture whereas Bacali<sup>20</sup> and coworker reported that their students found treating edentulism moderately difficult 68.2%. Sukotjo<sup>27</sup> and coworker observed that preclinical and lab exercises of making denture invited stress among the dental students. Eswaran<sup>28</sup> assess the complete denture diagnosis and fabrication among dental students of different years of various colleges in Chennai, they found knowledge and confidence level to fabricate complete denture was not significant and needed improvement.

There are contrasting results regarding difficulties and errors made by dental students when fabricating complete dentures. There are still no reliable methods to predict out come of complete denture faults.<sup>28</sup> However this study helped in highlighting the most frequently made errors by dental students so that teachers and mentors should focus more on those steps of denture fabrication so that post insertion denture complaints can be minimized.

## CONCLUSION

It can be concluded that the most frequent errors made by undergraduate BDSstudents were at the stages of artificial denture teeth set up and recording maxillomandibular jaw relations and increase in age and PDI complicates the denture fabrication.

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