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Processing Errors in Complete Denture Fabrication - A Survey

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ABSTRACT

There has been an increase in the incidence of complete edentulism among the elder patients. Complete dentures are the most common and preferred treatment of choice. Complete dentures help in masticatory function and restore the facial shape of the edentulous patients. Fabrication of the complete dentures is, therefore, a very important task for the clinician to ensure patient satisfaction. Errors may occur during the denture fabrication and these are called processing errors. It is a multifactorial process. The aim of the survey is to study the errors that occur during processing of a complete denture. It is a questionnaire based study conducted with a batch of 100 dental students. The questionnaire consisted of 16 questions focused on different fabrication techniques, timing, materials used, etc. by various students. The data collected was represented statistically and discussed. Dough technique was the most preferred method adopted by 39% of the students. Shorter curing cycles produced less defects, but majority of the students used longer cycles (41%). Most of them reported fractures (16%) and microporosities (11%) as defects. We can conclude that there are a few areas of error during the processing of dentures by the dental students. The incidence of these errors, however appears to be low. There is a scope for CAD/CAM complete dentures in the future to eliminate the possibilities of errors.

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INTRODUCTION

Complete dentures are the most preferred treatment of choice for completely edentulous patients (Cooper, 2009). It restores masticatory function and facial aesthetics (Carlsson, 2006). Thus fabrication of a complete denture is very important. It becomes the responsibility of the dentist to ensure a properly designed, planned and fabricated denture (Garfunkel, 1983; Nikolopoulou and Chrysostomidis, 2019).

Many factors lead to errors during the fabrication and processing of complete dentures. They can be dimensional changes, Investment materials, Expansion, Deflasking errors, Finishing errors, etc, (Fan *et al.*, 1981; Zarb *et al.*, 1997). Some examples can be the gypsum mixture consistency, Setting time for gypsum, Temperature of water, Deflasking method and Polishing the denture at the end (Kelly, 1972; Morris, 1997; Rahn *et al.*, 2009; Renner, 1981; Ren-

ner and Blakeslee, 1978).

Apart from fabricating a satisfying denture, maintaining gingival health is also important for a patient (Basha *et al.*, 2018; Jyothi *et al.*, 2017; Kannan and Venugopalan, 2018; Subasree *et al.*, 2016; Vijayalakshmi and Ganapathy, 2016). Such patients are easily prone to infections (Ariga *et al.*, 2018; Selvan and Ganapathy, 2016). Another option for completely edentulous patients are implants or implant supported dentures, etc. the patient can be diagnosed to check if implants are a good option for them (Ajay *et al.*, 2017; Duraisamy *et al.*, 2019; Ganapathy *et al.*, 2017). For patients with orocutaneous fistulas, aesthetics can be improved using a facial prosthesis that camouflages their facial defects (Ashok *et al.*, 2014; Venugopalan *et al.*, 2014). To prevent younger patients from becoming completely edentulous, they have to be aware of the conservative treatment options as well so that they don't wait till the tooth is completely affected and has to be removed. Popular options are ceramic restorations, crowns, veneers etc. (Ashok and Suvitha, 2016; Ganapathy *et al.*, 2016; Jain *et al.*, 2017).

This article aims at evaluating and assessing the processing errors that can occur during complete fabrication so that it can be carefully avoided in the future.

MATERIALS AND METHODS

It is a questionnaire based study on assessing the processing errors in complete denture fabrication. The participants were dental school students and dental practitioners. A questionnaire was prepared with a total of 16 questions that was asked to a batch of 100 participants. The Setting of the study was online through the platform Survey Planet. Ethnicity of the participants was mostly South Asian.

The collected data was analysed using SPSS software and compared by homogenization and cross verification. The test used was the Chi-square test to determine the correlation where P value < 0.05 is considered statistically significant. The pros were easy availability of data and the Cons were small sample size and geographical limitations.

RESULTS AND DISCUSSION

Out of the 100 participants about 57% were third years, 4% were first years, 14% were second years and 16% were fourth years. The participants who took the survey were mostly from third years (57%).

It was found that 39% of the participants preferred Dough technique, followed by 22% who preferred sprinkle on method and 15% used shellac base plate (Figure 1). A study by Nanda Kumar et al also showed similar results, where 60% used dough technique, 35% used to sprinkle on method, 11% used Shellac base plate (Kumar and Suresh, 2016).

Previous literature are in consensus. The most preferred technique turned out to be dough technique for the fabrication of dentures. Correlating technique with uniformity, we also find that dough technique gave 69% uniformity and sprinkle on method gave 54.5% uniformity in the thickness of dentures. (Figure 2). Therefore the dough technique resulted in more dentures with uniform thickness. The reason could be because dough technique is easy and less time consuming. It evenly spreads on pressure giving uniform thickness. The Chi-square test reveals p = 0.506, (p>0.05), statistically insignificant.

The present study also found that 41% of the participants felt that deflasking was easy, while about 38% found it difficult and 16% ended up breaking it (Figure 3). The study done by Nanda Kumar et al also stated that 45% found deflasking easy, 39% found it difficult, and 16% reported fractures while deflasking (Kumar and Suresh, 2016). Previous literatures are in consensus. The participants equally found deflasking either easy or difficult.

When asked what separating medium, they generally used, about 59% said they used cold mould seal, followed by 31% who used petroleum jelly and 7% said foils (Figure 4). The study done by Nanda Kumar et also showed similar results where 57% used cold mould seal, 39% used petroleum jelly and 14% used foils (Kumar and Suresh, 2016). Previous literature is in consensus. The separating media mostly preferred was cold mould seal (59%) followed by petroleum jelly. This could be due to easier handling.

We also found that only 62% of the participants paid attention to the polymer-monomer ratio during the fabrication of a denture. When asked about the time of manipulation 54% of the participants said during the early dough stage, 9% said during late the dough stage and 27% said during the stringy stage (Figure 5). Most of them manipulated the dough at the early dough stage (54%). Because the viscosity is just right during this stage and will flow easily under pressure.

About 41% of the participants opted for long curing cycles and 31% chose short curing cycles during the fabrication process (Figure 6). The study conducted by Nanda Kumar et al showed that 54% preferred using long cycles and 25% preferred short cycles (Kumar and Suresh, 2016). So longer curing

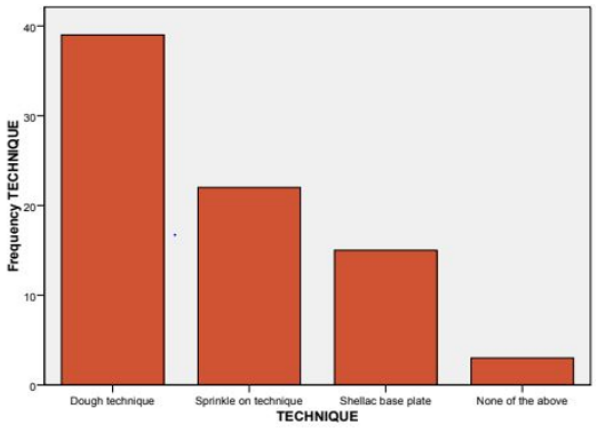

Figure 1: The Bar graph depicts the frequency of each technique adopted for denturefabrication.

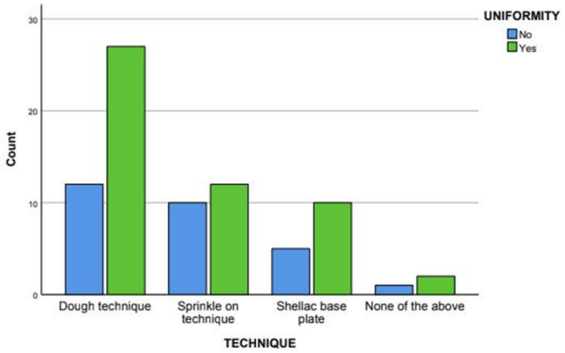

Figure 2: The Bar graph depicts the correlation between the techniques of fabrication and uniformity in denture thickness.

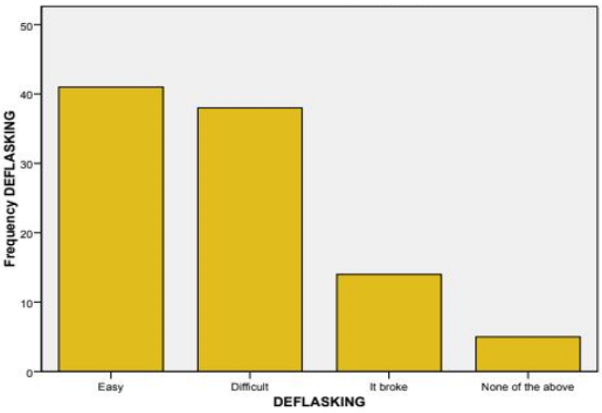

Figure 3: The Bar graph depicts what the students felt when deflasking.

cycles were more preferred during denture fabrication. We also found that about 60% of them placed it directly into the hot water (Figure 7), and only 52% of the participants were aware of the term trial closure (Figure 8).

When asked how long each of them wait before demoulding, 21% said one day, 19% said 2 hours, 17% said one hour and 16% said 30 min (Fig-

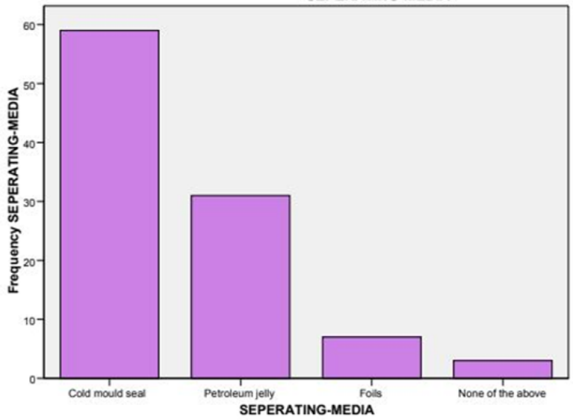

Figure 4: The Bar graph depicts the separating media used by the students.

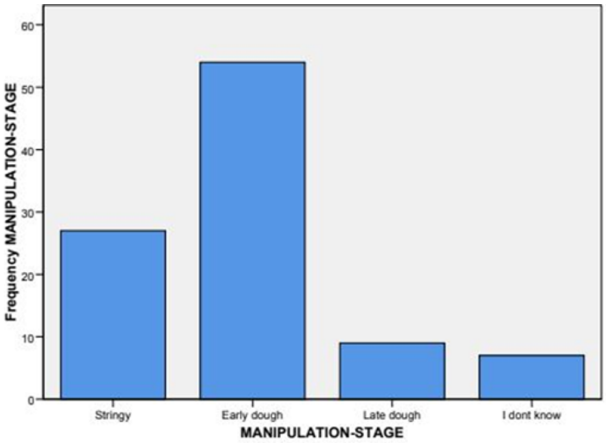

Figure 5: The Bar graph depicts the stages of manipulation that the students adopted.

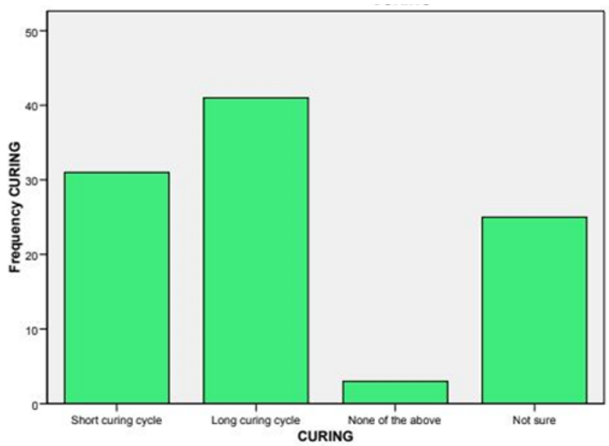

Figure 6: The Bar graph depicts the different curing cycles adopted by the students.

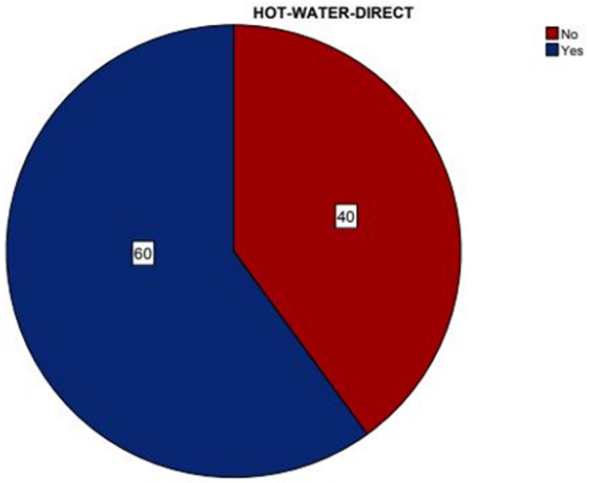

Figure 7: The Pie chart shows how many directly placed the flask in hot water.

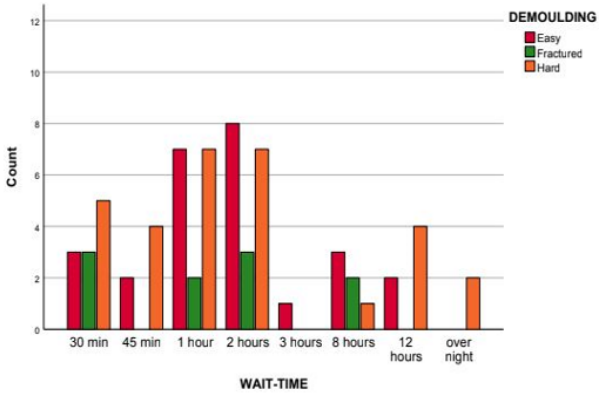

Figure 10: The Bar graph depicts the correlation between demoulding and waiting time.

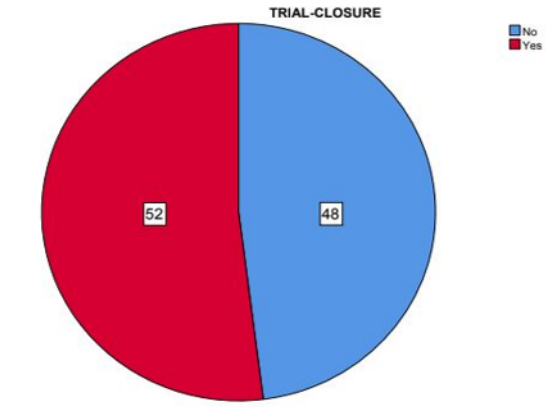

Figure 8: The Pie chart shows the number of students who were aware of the term trial closure.

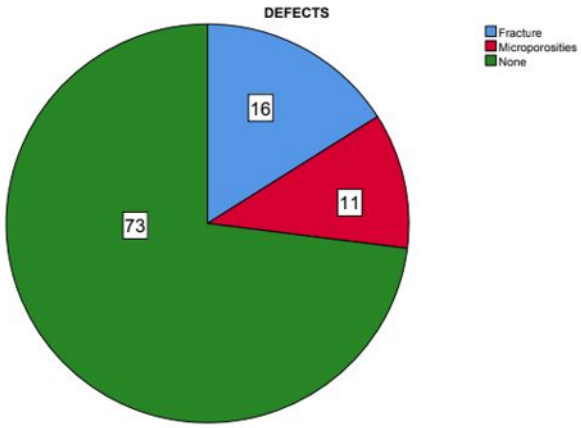

Figure 11: The Pie chart shows the types of defects observed during denture fabrication.

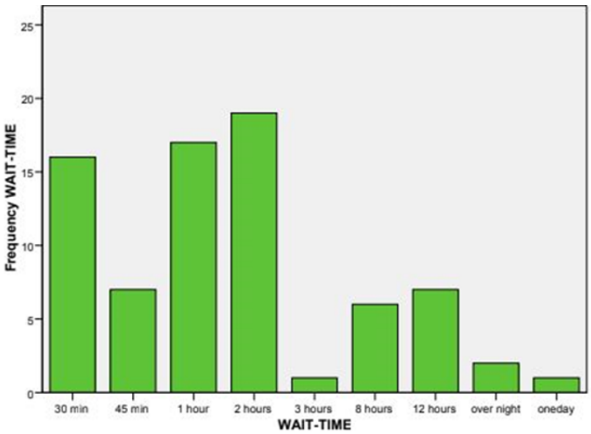

Figure 9: The Bar graph depicts the waiting time before the students demoulded the dentures.

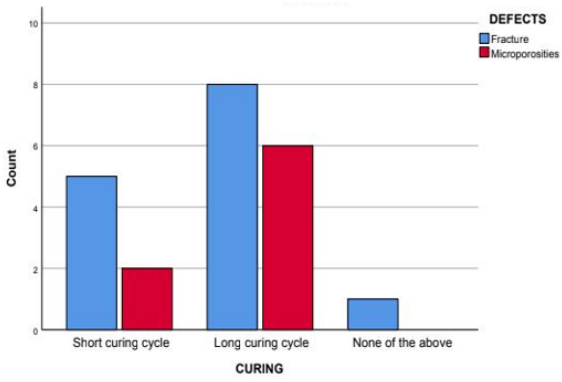

Figure 12: The Bar graph depicts the correlation between the curing cycles and defects.

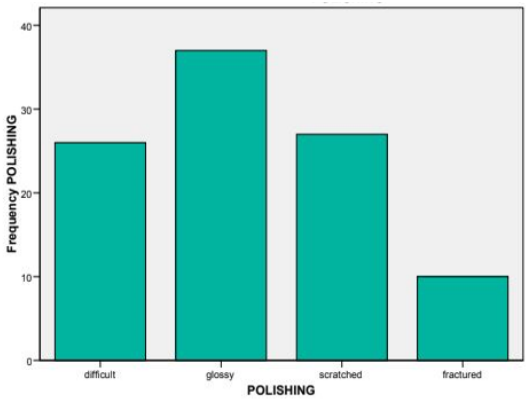

Figure 13: The Bar graph depicts the post polishing results achieved by students.

ure 9). About 21% of participants waited a whole day before demoulding. This is because it is essential to wait for it to completely cool before demoulding (Roraff and Stansbury, 1972). However on correlating waiting time and demoulding we found that it was easiest to demould after 2 hours (Figure 10); The Chi-square test reveals p=0.023, (p<0.05), statistically significant.

Around 16% of the participants reported fractures and 11% reported about porosities when asked about defects observed after curing (Figure 11). The study conducted by Nanda Kumar et al stated that 25% found fractures and 12% found porosities in their dentures (Kumar and Suresh, 2016). On correlating the curing cycles and occurrence of defects, we find that short curing cycles produce lesser defects (Figure 12). Although 41% preferred long curing cycles, short curing cycles produced lesser defects, The Chi-square test reveals p=0.6945, (p>0.05), statistically insignificant.

Finally, when the participants were asked what they observed after polishing the dentures, about 37% reported a glossy appearance, 27% reported a scratched surface and 10% reported fractured dentures (Figure 13). The study done by Nanda Kumar et al showed that 67% had a glossy finish and 21% did not (Kumar and Suresh, 2016). On polishing most of them attained a glossy appearance but 27% reported a scratched surface and said it was difficult. While 10% even reported fractures. The factors involved could be the amount of abrasive material used, whether the denture was wet enough and the holding position of the denture while polishing (Soni, 1976).

In Figure 1 X-axis denotes the techniques adopted for denture fabrication and Y-axis denotes the frequency of students that chose each technique. 39% of the participants preferred Dough technique, followed by 22% who preferred sprinkle on method and 15% used shellac base plate.

In Figure 2 X-axis denotes the methods of fabrication and Y-axis denotes the frequency of the dentures. Green bars represent the number of dentures with uniform thickness and the Blue bars represent the number of dentures without uniform thickness. Dough technique gave 69% uniformity and sprinkle on method gave 54.5% uniformity. The Chi-square test reveals p = 0.506, (p>0.05).

In Figure 3 X-axis denotes what the students felt when deflasking and Y-axis denotes the frequency of the students. 41% of the participants felt that deflasking was easy, while about 38% found it difficult and 16% ended up breaking it.

In Figure 4 X-axis denotes the different separating media used and Y-axis denotes the frequency of the students. 59% said they used cold mould seal, followed by 31% who used petroleum jelly and 7% said foils.

In Figure 5 X-axis denotes the stages of manipulation adopted during fabrication of dentures and Y-axis denotes the frequency of the students. 54% of the participants said they manipulated it during the early dough stage, 9% said during late the dough stage and 27% said during the stringy stage.

In Figure 6 X-axis denotes the curing cycles used during fabrication and Y-axis denotes the frequency of the students. About 41% of the participants opted for long curing cycles and 31% chose short curing cycles.

In Figure 7 Red portion represents the number of students who did not place it directly in hot water (40%) and Blue represents the number of people who directly put it in hot water (60%).

In Figure 8 Red represents the number of students who were aware and Blue represents the number of students who were not. Only 52% of the participants were aware of the term trial closure.

In Figure 9 X-axis denotes the time waited before demoulding and Y-axis denotes the frequency of the students. 21% of the students waited for one day, 19% waited for 2 hours, 17% waited for one hour and 16% waited for 30 minutes.

In Figure 10 X-axis denotes the waiting time and Y-axis denotes the frequency of the students. The red bars represent the number of students who found demoulding easy, orange bars represent the ones who found it hard and the green bars represent the number of dentures that got fractured while demoulding. It is easiest to demould after 2 hours of waiting time. The Chi-square test reveals p=0.023, (p<0.05).

In Figure 11 Blue represents fractures (16%), red represents micro-porosities (11%) and green represents no defects.

In Figure 12 X-axis denotes the curing cycles and Y-axis denotes the frequency of the dentures. The red bars represent the number of dentures with micro-porosities and the blue bars represent the number of dentures with fractures. Short curing cycles produced lesser defects. The Chi-square test reveals p=0.6945, (p>0.05).

In Figure 13 X-axis denotes the post polishing results and Y-axis denotes the frequency of dentures. 37% reported a glossy appearance, 27% reported a scratched surface and 10% reported fractured dentures.

Future scope

The introduction of CAD/CAM dentures can be encouraged to eliminate the possibilities of any form of errors.

CONCLUSION

From the data collected, we found that dough technique is the most preferred. Shorter curing cycles produced lesser defects. Demoulding is easiest after waiting for two hours. Errors may occur due to change in method, timing, ratio, etc. but the incidence was comparatively low. Thus we can conclude that though there may be a few errors made during the processing of a complete denture, the overall incidence of errors during complete denture fabrication by the dental students turned out to be low.

Conflict of interest

The authors declare that they have no conflict of interest for this study.

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