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Knowledge and Attitude of Dental Clinicians and Dental Technologists on Removable Complete Denture Fabrication Procedures in Uganda: A Qualitative Study

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Abstract

Removable Complete Dentures (RCDs) are crucial for restoring function and aesthetics in edentulous patients. The prevalence of edentulism rises with age, affecting 2.3% of the world's population. This study explored the knowledge and attitudes of dental clinicians and technologists regarding Removable Complete Denture (RCD) fabrication procedures at Makerere University Dental Hospital, Uganda. This qualitative study employed a phenomenological approach and 25 respondents were purposively selected to elicit data on a range of patient-specific considerations and needs during the Removable Complete Dentures fabrication process. Semi-structured interviews were conducted, and data were analyzed thematically. Respondents identified the critical steps in RCD fabrication, including examination and diagnosis, impression taking, determination of Occlusal Rim Block (ORB) height, proper jaw relation recording, and meticulous fabrication techniques during RCD fabrication, continuous professional development and patients' education, and went further to explain how these processes align with international guidelines. While dental clinicians and technologists generally adhered to international guidelines, our findings highlighted the need for updated and context-specific guidelines tailored to the Ugandan setting, as well as the importance of effective communication and synchronization among dental practitioners for successful RCD fabrication. The study highlighted dental clinicians' and technologists' knowledge of critical steps in removable complete denture (RCD) fabrication emphasized the need for updated, context-specific guidelines, particularly in impression taking, occlusal rim block height, removable complete denture fabrication steps, examination and diagnosis and patient education, to ensure accurate measurements and improved patient outcomes.

Keywords: *Attitudes, Fabrication Procedures, Knowledge, Removable Complete Denture.*

Introduction

Removable complete dentures (RCDs) are essential in prosthodontics treatment for edentulous patients. The RCDs offer both functional and aesthetic benefits enabling patients to chew, speak and smile confidently [1]. According to [2], the prevalence of edentulism increases with age, affecting 2.3% of the world's population. In Uganda, the prevalence of edentulism among people aged 20 years and above is 1.8% [2]. Complete tooth

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loss is a handicap, incapacity and disability [3]. Dental technicians play a pivotal role in the fabrication process of various dental prostheses, including RCDs [5]. Successful fabrication of RCDs requires a thorough understanding of prosthetic procedures, which significantly impact the patients' overall satisfaction [4]. The fabrication of RCDs involves several intricate steps, including diagnosis, treatment planning, accurate impression-taking and border molding, dental model casting and occlusal rim block fabrication, proper bite registration, selection and setting up of artificial teeth, wax denture try-in, acrylic packing, trimming and polishing. Dental technicians are responsible for translating the dentist's prescription into a well-fitting and aesthetically pleasing prosthesis to attain harmonious occlusion that is compatible with the stomatognathic system. The prostheses are intended to restore the patient's masticatory function, phonetics, esthetics and improved social esteem [6, 7]. According to [8] the quality of RCDs significantly influences the overall success of the prosthodontics treatment. Dental clinicians and technologists play a critical role in achieving optimal design and fit, ensuring that the final prosthesis meets the patient's needs and expectations [4]. Their knowledge of the latest materials and techniques is vital for ensuring the quality and longevity of RCDs. Studies [9, 10] have shown that the knowledge and attitudes of dental clinicians and technologists significantly influences the quality of the final prosthesis. Furthermore, for impression techniques, (50.4%) of contributors favoured using the mucostastic technique, though muco-compressive and selective pressure techniques were chosen by (12.6%) and (37.0%) respectively [9]. In a survey conducted in Nagpur city on 200 private dental practitioners (62% males and 38% females) concerning dentists' attitude about relining procedure of RCDs, eighty-one percent (81%) of the dentists think that relining increases the retention and stability of the denture whereas 14% did not feel so and 5% were not sure about it while thirty-nine percent (31%) of dentists thought relining might increase the vertical dimension of the dentures [10]. Gaining an understanding of the processes involved in fabricating RCDs is expected to facilitate education and training of dental practitioners in prosthodontics care given to patients. This study explored the knowledge and attitudes of dental clinicians and technologists regarding RCD fabrication procedures in Makerere University Dental Hospital, Uganda.

Materials and Methods

Study Design

The study employed a qualitative study design to investigate knowledge and attitudes of dental clinicians and technologists regarding RCD fabrication procedures. Data were collected using key informant interviews.

Study Site

The study was carried out in Makerere University Dental Hospital in Kampala, Uganda. Kampala is the capital city of Uganda. The hospital is a teaching and healthcare service delivery facility for Makerere University. It is the biggest and well-equipped dental facility in Uganda, employing the biggest number of dental specialists. The hospital offers specialized dental services including rehabilitation of edentulous patients with RCD to university employees, students and the surrounding community. It has a well-established prosthetic dental laboratory. The hospital attends to about 660 outpatients per month, 20 of whom receive RCD therapy (Registry of Dental Records, 2022).

Selection of Study Respondents

Key informants were purposively selected, taking into account the duration of practice, level of training, roles in denture fabrication and fitting in order to provide an equitable representation of the study population. The 13th dental clinician and the 12th technologist did

not provide any new information on knowledge and attitudes of dental clinicians and technologists regarding RCD fabrication procedures and were deemed to have attained data saturation [11, 12].

Inclusion Criteria

Dentists and dental technologists involved in the provision of RCDs in Makerere University Dental Hospital and have provided written informed consent.

Exclusion Criteria

Dental technologists and clinicians who were ill or absent at the time of data collection.

Data Collection

A pilot was conducted prior to actual data collection to test and modify the research tool accordingly. Before participating in the study, the respondents provided written informed consent and were assured of confidentiality without personal identifying information during collecting data or compiling reports. The research assistants personally invited respondents to participate in an interview environment that was both welcoming and conducive for them to discuss freely.

To promote conversation and uncensored opinions on many aspects of knowledge and attitude, semi-structured interviews were conducted for each respondent that lasted 30 to 45 minutes. Interviews were audio-recorded in addition to note-taking. Additional notes were also taken to record body language expressions.

Data Management and Analysis

The interview recordings were transcribed verbatim and compared with written notes where emerging and recurrent themes were identified. The data were securely kept under lock and key, while the soft copies were computer password protected and only accessible to the investigators. After transcription, the data from 12 dental technologists and 13 dental clinicians were coded to form a code book. The code book was imported into Nvivo 14 for thematic analysis [13]. Personal knowledge and attitudes were represented by individual quotes from the respondents.

Quality Control

To improve the validity and reliability of the data collection tools, the principal investigator pretested them and made adjustments. The research assistant who had a background of social sciences was trained in data collection. The key informant interviews were audio-recorded in order to capture any discussion that might have been missed during note-taking. Additional notes were also taken to record body language and gestures of the respondents.

Credibility, Confirmability, Dependability, and Transferability were used to guarantee trustworthiness. Peer debriefing and enlisting the assistance of more experienced qualitative researchers to review and provide feedback on the study procedure and findings to guarantee that the data were correct and pertinent helped to establish credibility. A thorough explanation of the research context, including the features of the chosen respondents and setting was given in the methods section. Readers are advised to utilize this description to determine whether or not they can apply the findings to their contexts or settings. A detailed description of the study procedures and analysis was provided in order to enable study replication. To ensure that the study conclusions are based on the respondents' narratives and words and free from bias, a clear coding scheme was utilized to generate codes and uncover trends in the analysis [14].

Ethical Considerations

The study protocol was approved by Makerere University School of Health Sciences Research Ethics Committee (Reference Number: MAKSHSREC-2023-486) and the Uganda National Council for Science and Technology (Reference Number: HS3092ES). Permission to carry out the study was given by the Makerere University Dental Hospital

administration. Written informed consent was obtained from each participant before the study. In compliance with the Helsinki Declaration [15], the respondents were requested to voluntarily participate after being made aware of the purpose of the study. Care was taken to ensure confidentiality and anonymity of all personal data generated during the study.

Results

All respondents: 13 dental clinicians and 12 dental technologists had a Bachelor of Dental Surgery and Bachelor of Dental Technology, respectively. Majority of respondents were 26 to 35years of age and more than half (18/25) were male (Table 1).

Table 1. The Frequency Distribution of the Respondents According to their Social Demographic Characteristics (N=25)

Characteristics	**n (%)**
Sex	
Male	18 (72)
Female	7 (28)
Role	
Clinical work	13 (52)
Laboratory work	12 (48)
Age	
18-25	6 (24)
26-35	14 (56)
36-45	5 (20)
Level of Education	
Bachelor of Dental Surgery	13 (52)
Bachelor of Dental Technology	12 (48)

Table 2. Themes and Subthemes

Theme	**Subthemes**
Patient informed consent and assessment	• Psychological preparation and informed consent • Examination, diagnosis and mouth preparation
Fabrication steps	• Impression taking • Determination of ORB height • Materials used • Knowledge exchange among dental practitioners • Denture delivery

The study sought to ascertain the knowledge and attitudes of Dental Clinicians and Technologists on Removable Complete Denture fabrication procedures in Makerere University Dental Hospital, Uganda. Two themes emerged from the data (Table 2).

Patient Informed Consent and Assessment

Psychological Preparation and Informed Consent

Respondents mentioned that the first thing to do is psychologically prepare the patient before

all other procedures. In fact, patients' consent was believed to be the most important step in the complete denture fabrication process.

> *"The key first step is where the patient accepts and consents to be part of all the processes. What is key is a patient agreeing to the terms and conditions and fulfilling the appointment stages" (P001_40-year-old_dental surgeon).*

> *"You have to psychologically prepare a patient for the dentures. Then do examination, treatment planning, diagnosis which is a gradual process [and] not a single step [activity]. " (P007_27-year_dental surgeon).*

Similarly, patients' preparation was associated with giving a detailed explanation of the RCD benefits, related risks, fabrication stages and costs involves, and its maintenance so that by the time the other clinical procedures are complete, the patient is fully aware of what exactly she/he is going to experience and to expect.

> *"The key steps should be done after explaining to the patients all the clinical and laboratory procedures. After they have understood, then you can start the treatment. Many of the patients come when they have no idea about the complete dentures to the point that they think it's a fixed prosthesis" (P003_43-year-old_dental surgeon).*

The dental practitioners indicated the importance of explaining to the patient because it is part of the process of giving detailed information about the procedure before obtaining informed consent. Therefore, only those who accept to go through the process are taken through procedures.

> *"Of course, there is patient examination, which is an important aspect. After that the patient might accept or not, if they accept you take the primary impression and continue with the therapy" (P008_25-year-old-Dental Technologist).*

Examination, Diagnosis and Mouth Preparation

Respondents mentioned several steps they had to go through during RCD fabrication and these included examination and diagnosis, which also involved assessing the patient's oral condition, facial expressions, overall health and mouth preparation.

> *"The first thing we normally do is mouth preparation which helps to make sure that the mouth environment is ready for the removable complete denture. So, we start with removal of any rotten teeth" (P002_42-year-old_dental surgeon).*

During examination and diagnosis, all respondents demonstrated clear understanding of what the key steps in denture fabrication were. Some respondents called it analysis while others called it diagnosis. The excerpt below gives more detail of the procedures.

> *"When the client comes, you examine him/her, take history, and analyze the mouth and the facial expression. The extra oral and intra oral examination helps to determine if the patient qualifies for a removable complete denture before taking the primary impression" (P004_33-year-old_dental surgeon).*

Fabrication Steps

Impression Taking for Removable Complete Denture Fabrication

We asked the respondents what they knew about impression taking. Our findings revealed that respondents understood that impression taking is very critical for successful complete denture fabrication. One respondent compared impression taking to cooking food while showing that if the impression is well taken, it will lead to a better complete denture fabrication. Likewise, if a wrong impression is

taken, it will lead to poor complete denture fabrication.

> *"Impression taking is like cooking food, if the cook messes the dish, the one who is going to take it will not enjoy it. Impression taking is the key thing in all the processes of removable complete denture fabrication" (P001_40-year-old_dental surgeon).*

Similarly, other respondents held a similar notion that impression taking was not only a good foundation, but it also influenced the outcome of the process. To some respondents, impression taking is very important as it is the mouth of the patient. They narrated that the patient's mouth becomes as good as the impression taken.

> *"I think that a good impression is a foundation for the entire process because if you make a very bad impression everything else [procedures/processes] will not work" (P002_42-year-old _dental surgeon).*
>
> *"A good impression should produce a cast whose dimensions represent the exact replica of the patient's mouth. Otherwise, if there are some errors in impression taking, it is obvious the complete denture will be ill fitting" (P008_25-year-old_Dental Technologist).*

Some respondents further emphasized the importance of impression taking by indicating that there should not be room for error because in case of any wrong measurements, all other steps will go wrong. Meaning, impression taking should be accurate. They narrated that in case the complete denture is faulty, it means the primary impression may not have been correctly taken and thus, requires an accurate secondary impression. One of the respondents affirmed that if the primary impression was wrongly done, the secondary impression has to be very accurate by all means.

> *"If you take bad impressions, oftentimes you get non-retentive and unstable complete dentures. So, sometimes you have to redo a secondary impression to be accurate" (P013_25-year-old_Dental surgeon).*

Another respondent added that it was very important to take good impression and believed that impression taking should consider all the three techniques (muco-compressive, selective, and muco-static) in order to rule out any mishaps. She indicated that taking all the impressions at ago saves a lot of time because there would be no need of repeating them in future.

> *"There are different types of impression techniques. We have muco-compressive, selective, and muco-static. Taking both the primary and secondary impressions in one day saves a lot of time for both the dental clinician and technologist" (P014_23-year-old_Dental surgeon).*

Determination of Height of ORBs for RCD Fabrication

Another step in RCD therapy is fabrication of ORBs. Dental clinicians and technologists mentioned that they follow international standard guidelines, found in most textbooks, in the removable complete denture fabrication processes. These guidelines include specific measurements for the height and thickness of ORBs.

> *"I follow what is written in the textbooks in measuring the height and width of the occlusion rim blocks" (25-year-old-dental technologist).*

However, despite the existence of international standard guidelines, there was a consensus among the professionals that each patient is unique and this compels them to do individual adjustments. Factors such as jaw size, facial morphology and comfort play a crucial role in determining the optimal height of ORBs. Some clinicians emphasized the importance of being adaptable and making adjustments based on the patient's specific needs.

"Every client is different. I will not tell you that there is one standard fit for all, it is usually patient-based. There are principles that may apply on one patient, and may not apply on the other, but the best thing is to treat every patient individually" (P007_27-year-old dental surgeon).

"Someone can have occlusal rim block height of 18 mm, the other one has 20 mm, and another one has 15 mm. The textbooks say a certain height [18mm for mandible and 20mm for maxilla], but you realize that you have to adjust for different people" (P019_24-year-old_Dental surgeon).

Some respondents attributed the lack of context-specific guidelines to lack of research about the RDC fabrication processes in other settings like Uganda. This makes it hard for the dental practitioners to use the available guidelines as they may not be easily adapted to the local context.

"We don't have literature on our own people especially on the [fabrication and] use of removable complete dentures. And if there was any research, I think it would be very informative in this field. In Africa, and Uganda in particular, we don't have much data on that [removable complete dentures]" (P021_45-year_Dental Surgeon).

Some respondents narrated that the available standards have helped them to do the right measurement procedures while admitting that, the few adjustments are made due to the fact that there are height differences.

"Yeah, a few adjustments still can come in, but that standard is like something that is fundamental for us. We can make small changes later" (P023_26-year-old_Dental Technologist).

To some dental practitioners, reference to the international standard guidelines was helpful in avoiding mistakes that could affect the patients' comfort.

"There is the height and the width of the occlusal rim blocks that are internationally recommended. So, it is best to follow that. Then for the lower occlusal rim blocks, of course it should be angulated at 90 degrees to the base" (P024_26- year-old_Dental surgeon).

Materials Used During RCD Fabrication

We also explored our respondents' knowledge about the kind of materials used during removable complete denture fabrication. Our findings revealed a number of views about key materials used including; heat cure and cold cure polymethyl methacrylate (acrylic) powder and liquid, chromo-cobalt metal alloy, silicon (soft and hard bodies), alginate, acrylic teeth, dental stone, and wax.

"Yeah the first thing, I already have the stock trays which are bought from the market. Those are the first trays in most cases, I use them with alginate for my primary impressions. Then after I fabricate the special tray, which I use together with silicon to take the secondary impression" (P001_40-year-old_Dental surgeon).

"At the clinic where I work, we have always used alginate. Initially, we had addition silicon, but then it got finished and we didn't buy more, but compromised and started using alginate, which is cheaper" (P002_42-year-old_Dental surgeon).

Another participant indicated how different materials are used for different purposes and stages, revealing that while some materials are used during the primary impression taking, other materials are used for secondary impression or for making the denture base.

"The commonly used material in the dental clinic for primary impression is alginate while [the one used] for secondary impression is silicon. In the

dental laboratory, we have self-cure and heat cure acrylic powder and monomer for making special trays and base for occlusion rim blocks, acrylic teeth, dental stone, and wax" (P005_30-year-old-Dental Technologist).

Knowledge Exchange Among Dental Practitioners During RCD Fabrication Procedures

We explored respondents' knowledge exchange practices during the RCD fabrication. Our findings revealed that dental practitioners mainly discuss about a suitable course of action for a given patient, or areas where they would need extra help as professionals or sometimes knowledge exchange takes the form of giving instructions about the procedure.

"I definitely share knowledge by giving instructions as well as discuss and agree on what I exactly want with the technologists" (P017_33-year-Dental Surgeon).

"Yes, it is frequent. I think in this kind of practice, you have to frequently talk to colleagues to share knowledge. I don't think one would work alone, but there is something you learn from your colleagues when you share and work with them" (P017_33 year_Dental Surgeon).

Denture Delivery

We explored respondents' knowledge on denture delivery. Our findings revealed that denture delivery involved retention and stability check and speech. This was followed by RCD review and adjustment, patient education, and then final delivery of the RCD to the patient.

"I assess speech and see whether the patient is comfortable with the denture, the color of the teeth, retention, stability and if satisfactory then, I deliver the denture and follow up" (P007_27-year_dental surgeon).

Discussion

The study explored respondents' knowledge and attitude towards RDCs fabrication procedures. In terms of knowledge, during examination and diagnosis, respondents demonstrated a clear understanding of key fabrication steps, with some referring to it as "analysis" while others as "diagnosis". The fabrication of RCDs demands a logical approach to ensure successful outcomes. Studies by [16, 17] detailed the critical steps in the examination and diagnosis, which involved a comprehensive assessment of the patient's oral condition, facial expressions, and overall health.

In the present study, respondents reported a series of steps including examination and diagnosis, mouth preparation, impression taking, fabrication of ORBs, bite registration, articulation, setting of teeth, try-in wax RCD, acrylic packing, review and adjustment, patient education, final delivery of the RCD, and post-insertion care which align with international standard guidelines [16, 17]. Dental clinicians and technologists attempted to adhere to international standard guidelines, but ended up with adjustments of the ORBs. Patient preparation involves detailed explanations to manage expectations and obtain informed consent. It is emphasized to follow rigorous RCD fabrication procedures to avoid challenges that could affect patient outcomes. Other studies [18, 19] highlighted the importance of adhering to established guidelines and standards to ensure positive patient outcomes.

The respondents in the present study demonstrated a comprehensive understanding of the importance of impression taking in RCD fabrication. They likened it to a crucial step in cooking, where a well-taken impression ensures a successful outcome, while a wrong impression leads to poor fabrication. This finding is consistent with the results of a literature review [20], which questioned the necessity of certain clinical and laboratory

procedures, such as a two-step impression procedure, for achieving better results in conventional RCD fabrication. Additionally [20], reviewed randomized controlled clinical trials comparing RCD fabrication with one-step versus two-step (primary and secondary) impression procedures and found that contrary to conventional belief, a two-step procedure may not be mandatory for successful denture fabrication.

Dental practitioners use international standard guidelines for establishing the height and thickness of ORBs during the fabrication of RCDs. Comparably, in a Ugandan study [21], the mean height of the mandibular and maxillary ORBs before bite registration/adjustment was found to be in line with international standard guidelines and produced a 2-4 mm freeway space. In [20] trials, some practitioners closely followed these recommendations (international standard guidelines for establishing the height and thickness of ORBs) to prevent any problems, others stressed the significance of flexibility and patient-specific modifications. In addition, [20] trials, emphasized the individuality of every patient, which calls for customized changes depending on variables including comfort, jaw size, and face morphology, even in the presence of worldwide guidelines. Indeed, [21] discovered that, following bite registration/adjustment, the height of ORBs for both the upper and lower jaws was 2.2 mm shorter than the global standards. The observed variations in RCD dimensions are in corroboration with [22] who also noted specific needs particularly among the elderly patients. It is challenging for practitioners to rely only on guidelines from outside Uganda, despite dearth of Ugandan-specific literature on RCD fabrication. However, [20] trials, concluded that following these worldwide standards is useful in guaranteeing precise measurements and preventing mistakes that can affect patient outcomes [3].

During the fabrication of RCD, various dental materials are utilized at different stages of the process [23-25]. The present study revealed that dental clinicians and technologists recognize the diverse purposes of different materials at various stages of RCD fabrication, indicating a comprehensive understanding of the respondents regarding material selection and utilization throughout the process.

In terms of attitudes, the present study noted both best practices as well as gaps in sharing the knowledge among dental practitioners during RCD fabrication procedures. This was in support of the findings by [26] who suggested several ways to enhance knowledge sharing between dental clinicians and technologists, such as using phone calls and sending photos instead of written requests. Respondents emphasized the significance of frequent sharing of knowledge as a means for practitioners to learn from each other and enhance treatment planning within the dental team and echoed the need for improved knowledge sharing as earlier highlighted [26, 27].

Conclusion

The present study highlighted dental practitioners' knowledge of critical steps in RCD fabrication including examination and diagnosis, impression taking, determination of height of ORB and patient education. While respondents generally adhered to international guidelines, the findings highlighted the need for updated, context-specific guidelines tailored to the Ugandan setting. There was emphasis on the importance of having a good knowledge of RCD fabrication procedures and appropriate attitudes about knowledge sharing of good practices during RCD fabrication.

Recommendations Based on the Findings

Develop and implement comprehensive training programs for dental clinicians and dental technologists focusing on knowledge and attitude in meticulous RCD fabrication techniques. Update existing international

standard guidelines for RCD fabrication to address specific challenges faced in the Ugandan context. Promote continuous professional development among dental clinicians and dental technologists to keep them updated with the latest advancements in RCD fabrication.

Implications for Clinical Practice

Enhance the quality of patient care by ensuring accurate and meticulous fabrication techniques during RCD therapy. By following updated and context-specific guidelines, dental practitioners can ensure that RCDs meet patient needs and expectations, leading to increased patient satisfaction. Continuous professional development will keep dental clinicians and technologists updated with the latest advancements in RCD fabrication, ensuring that they provide the best possible care to their patients.

Implications for Future Research

Explore the need for the development of context-specific guidelines for RCD fabrication in Uganda to address the specific needs of the local population.

Study Limitations

The study relied on subjective interpretation by respondents, and the findings may have been influenced by the recall biases and perspectives. However, efforts were made to minimize this bias through rigorous data analysis and triangulation of findings.

Ethical Considerations

The study protocol was approved by the Makerere University School of Health Sciences Research Ethics Committee (Reference Number: MAKSHSREC-2023-486) and the Uganda National Council for Science and Technology (Reference Number: HS3092ES). Permission to carry out the study was given by the Makerere University Dental Hospital administration. Written informed consent was obtained from each respondent before participating in the study in compliance with the Helsinki Declaration [15].

Consent for Publication

Not applicable.

Availability of Data and Materials

On request, data sources are made available from the corresponding author through: nndvd45@gmail.com.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Author’s Contributions

DN, IO, MA, GB, and CMR participated in the conception of the study, study design, data analysis, and manuscript preparation. DN and GB participated in data collection. All authors read and approved the final manuscript.

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