Assessment of the Knowledge about Routine Laboratory Procedures in Fabrication of Fixed Dental Prostheses amongst Dental Laboratories in Western Maharashtra Region

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ABSTRACT

BACKGROUND

The success of fixed dental prosthesis (FDPs) delivered to the patients depends upon the implementation of appropriate laboratory procedures and dental materials which are required during fabrication of that prosthesis. Inappropriate technique during its fabrication may not always hamper the esthetic end results or fit, but may also hamper the longevity as well. Thus, knowledge about the dental materials as well as the basic laboratory procedures among the dental laboratories should be regularly assessed to assure good quality work. This survey was conducted to assess the knowledge among laboratory technicians regarding the routinely used laboratory procedures and materials for fabrication of FDPs in dental laboratories in Western Maharashtra region with the help of a validated questionnaire.

METHODS

An electronic survey was conducted with the help of a validated questionnaire that was circulated to 49 laboratories in Western Maharashtra region. The feedback was gathered from laboratory technicians and was then statistically analysed to achieve the objectives of the study.

RESULTS

48.8 % of laboratories confirmed that technicians working for them were registered under the state council. 51 % agreed that they only used dental materials that were American Dental Association (ADA) specified. The most common gypsum product for pouring of impressions was dental stone. 65.9 % of the technicians agreed that they inspected the cast before starting the fabrication procedure. Die preparation and ditching procedure was done by 52.9 % and 35.7 % laboratories respectively. Only 38.1 % agreed of using beryllium free alloy ingots; in 66.7 % laboratories, ceramic work was carried out in a separate ceramic room with 76.2 % having adequate ventilation provisions.

CONCLUSIONS

Response of technicians in Western Maharashtra region regarding their knowledge about basic laboratory procedures in FDP fabrication indicates several areas of weakness. Avoiding such inadequacy in laboratories can significantly reduce FDP failure rates.

KEY WORDS

Fixed Dental Prosthesis, Dental Laboratory, Survey

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BACKGROUND

The field of prosthodontics is one of the most demanding disciplines of dentistry comprising of both clinical and laboratory procedures. When prosthetic rehabilitation of a patient is advised, there are several treatment options ranging from removable to fixed prostheses that a patient can select from. Selection of a specific treatment option for the patient largely depends upon several factors such as; age, systemic condition, economic and time constrain, condition of remaining intraoral structures etc. The improvements in public attitude and awareness towards dentistry has led to patients willingly opt for more complex and extensive treatment options than before. With this, it has become even more challenging for the dentists trying to satisfy the requirements of the patients in providing the required dental treatment. Considering comfort as one of patient's prime requirement, preference of fixed prosthesis over removable is always higher. Thus, fixed dental prostheses (FDP) has become one of the most important part in the field of prosthodontics. A fixed prosthesis provides exceptional satisfaction to both patient and dentist in treatment of missing dentition by adequately restoring form, function and aesthetics. The fabrication of high quality, durable dental prosthesis is considered a reflection of the skills of both the dental practitioner and dental technician. Several factors play a key role in success of FDP directly by the dentist such as clinical management of the patient, case selection, tooth preparations, adequate impression making, cementation and follow up. Another important aspect is carefully transferring the dental impressions and / or dental casts to the dental laboratory and providing all the detailed information required for fabrication of the required prostheses.¹

Once adequate information is provided to the dental laboratory by the dentist, the skill and knowledge of the dental laboratory technicians is greatly responsible for fabrication of FDP that in turn affects the treatment outcome. Studies have emphasised the role of adequate communication and cooperation between dentists and dental laboratory technicians for any successful prosthodontic treatment.¹ Apart from communication, the success of a FDP delivered to the patient depends upon the implementation of appropriate laboratory procedures during fabrication of that prosthesis.² If improper and inadequate techniques are followed during the fabrication of any fixed prostheses, it may not only affect the aesthetic end results or fit but may also hamper their longevity. An improperly designed FDP may result in a prosthesis that has been fabricated with little or no reference to the important clinical or biological information. This in turn may potentially cause tissue damage and ultimately lead to failure of treatment. Having adequate knowledge of all the basic laboratory procedures in fabrication of FDP allows the working technicians to fabricate a prosthesis which is biologically, aesthetically and functionally appropriate. Thus, it is important to assess the knowledge regarding the basic laboratory procedures in fabrication of FDP among the dental laboratory technicians. This study intends to evaluate the

knowledge of basic fabrication procedures followed by the laboratories for fabrication of FDP through the help of an electronic survey administered to the laboratory technicians in Western Maharashtra region.

METHODS

A cross sectional electronic survey was conducted to assess the knowledge among laboratory technicians regarding the routinely used laboratory procedures for fabrication of FDPs in dental laboratories in Western Maharashtra region with the help of an online questionnaire. Study duration was from February 2019 to May 2019.

The questionnaire was first piloted for validation on a small number of dental technicians available locally. It was distributed personally to laboratory technicians available locally and the results were analysed. Accordingly, the validity of the questionnaire was assessed and necessary changes were made in the questions. The final questionnaire consisted of 29 dichotomous questions covering the basic laboratory procedures in fabrication of FDPs. The electronic survey link was then distributed to 49 laboratories randomly around Western Maharashtra region through emails and messages with a 15 days' deadline to answer. The identity and information of all the laboratory technicians who participated in the survey were kept anonymous. The feedback was then gathered from laboratory technicians and was analysed to achieve the objectives of the study.

Statistical Analysis

All the gathered responses were tabulated and entered into Statistical Package for the Social Sciences (SPSS) version 10.0 software. The data was analysed, and the analysis was restricted to descriptive percentile statistics using mean values.

RESULTS

The response rate was 73.4 % with 36 out of the 49 laboratories responding to the survey within the stipulated time period. The cumulative results of the survey are presented in Figures 1 to 3. 48.8 % of laboratories confirmed that technicians working for them were registered under the state council. 51 % agreed that they only used dental materials that were International Standards Organization / American Dental Association (ISO / ADA) specified. 48.8 % of the work received by the labs was in the form of impressions. Disinfection of impressions before starting the procedures was carried by 28.6 % of laboratories.

The most common gypsum product for pouring of impressions was dental stone (47.6 %), followed by die stone (28.6 %) and dental plaster (less than 15 %). 64 % of laboratories added gypsum product to water for mixing, with 40.5 % of them using vacuum mix.

Figure 1. Response of Participants Regarding CDL Knowledge, Registered Working Technicians, Work Received as Impressions, Whether or Not Steps Such as Impression Disinfection, Cast Articulation, Vacuum Mixing, Water : Powder Ratio, Base Pouring, Setting Time and Cast Inspection were Followed in Dental Laboratories

*CDL (Certified Dental Laboratories)

Figure 2. Response of Participants on Whether or Not Steps of Die Preparation, Die Ditching, Finish Line Marking, Use of Contrasting Pencil, Applying Die Spacer, leaving 1 mm Space from Margin while Applying Die Spacer, Used Different Waxes for Pattern Fabrication, Expansion Liquid: Powder Ratio of Investment Material and Expansion Liquid: Water Ratio were Followed

The manufacturer recommended water powder ratio was followed by 59.5 % laboratories, whereas 40.5 % followed the manufacturer recommended setting time. 65.9 % of the technicians agreed that they inspected the cast before starting the fabrication procedure. Die preparation and ditching procedure was done by 52.9 % and 35.7 % laboratories respectively.

While 41.1 % laboratories marked the finish line on the die, only 42.9 % of them used a contrasting pencil to do the same. 49.9 % of technicians used die spacer with 50.5 % leaving 1 mm space from the margin. 64.3 % used different waxes indicated while carving the wax patterns for FDPs.

Considering the investment procedure for wax patterns, 71.4 % followed the recommended liquid to powder ratio of the investment material, while 73.8 % followed the expansion liquid to water ratio recommended by the manufacturer. Only 38.1 % agreed of using beryllium free alloy ingots and having knowledge regarding berylliosis. In 66.7 % laboratories ceramic work was carried out in a separate ceramic room, with 76.2 % having adequate ventilation provisions. 61.9 % practiced reuse of the sand in sand blasting unit several times. Regular ceramic firing unit calibration was done by half of the participants.

DISCUSSION

With increasing awareness and knowledge of patients regarding their own dental health, there has been a tremendous change in their attitude and responses to the treatment they receive in a dental clinic. With information about the advanced and more comfortable treatment modalities available, patient's interest has shifted towards fixed prostheses than removable ones. The ethical and legal responsibilities of both the dentist and dental laboratory technicians play a key role in successfully treating a patient. Relying only on the dentist's knowledge and authority to delegate laboratory procedures based on the functional and esthetical demands of the patient is not sufficient. The assistance provided by dental laboratory technicians in fabricating a prosthesis is equally important. Several surveys have been carried out in the past to evaluate the efficiency of communication between the dentist and lab technicians.²⁻⁶ Results of these studies have greatly improved the current communication strategies between the two for improved quality of work.

However, one of the major concerns that has not been focused upon is the use of correct techniques in fabrication of prostheses especially for fixed crowns and bridges that require great precision and fit. Improved communication in fabricating FDPs would be of no use if the final prosthesis is not satisfactory due to improper fabrication techniques. This survey study was specially designed to assess the knowledge amongst dental laboratory technicians regarding the routine dental laboratory procedures in fabrication of FDPs in western Maharashtra region.

Cumulative evaluation of the entire survey showed that a mean of 52.2 % followed the correct technique and had adequate knowledge about the same. It was found that only

48.8 % were registered under state council and only a quarter of the participants were aware about the specifications provided by the Dental Council of India through the Clinical Establishment Act Standards for Dental Lab.⁷ Protocols regarding laboratory setup provided by them should be followed by all dental technicians as it provides highest standards of professional laboratory excellence in India. With only about 25 % laboratories using articulators in fabrication of FDP shows the lack of adherence to proper technique. Hand held casts during fabrication of single or multi-unit FDPs do not provide adequate maxillomandibular relationship and might lead to improper occlusion or discomfort to the patient after final cementation.⁸ Another very important and commonly neglected step by laboratories is disinfection.⁹ Following robust disinfection protocols is of utmost importance to prevent cross-infections between the patient, dentist and lab personals.

In the present survey, 71.4 % laboratories did not follow standard disinfection protocol, thereby increasing the risk of cross contamination and infection. Similar results were recorded by Kugal G et al.¹⁰ and Hatzikyriakos A et al.⁴ in their studies to evaluate the efficiency of dental laboratories to implement disinfection protocol for impressions. This suggests that awareness and practices of dental technicians regarding cross-infection control are less than ideal and must be improved. However, the technicians must also be aware to avoid repetitive disinfection as it poses a risk of dimensional stability changes and also hamper the surface detail reproduction.¹¹ for this, the communication between dentists and dental technicians is essential.

Dental cast is a positive replica of the teeth and surrounding tissue. Various factors are responsible to obtain a good quality dental cast; such as the dental material used, following the manufacturer recommended water powder ratio, mixing technique, setting time, base pouring and finally

inspecting the cast thoroughly before initiating with the fabrication procedure. In the present survey, knowledge regarding the above factors ranged between 40.5 % to 65.9 % with a mean value of 41.7 %. It is important that laboratories not only critically evaluate the dental cast that is obtained but also give importance to all the steps from pouring of cast to the final setting period. Failure to do so might lead to fabrication of a fixed prosthesis that may adequately fit on the cast but not intraorally when trying it in the patient's mouth.

Die preparation is another important step in FDP fabrication. The present survey concentrated only on whether or not the die preparation was carried out by the laboratories. About 50 % responded positively to the question. Similarly, less than half of the laboratories followed steps of die ditching, marking the finish line in contrasting color and die spacer application 0.5 to 1mm above the finish line. A long term FPD requires adequate fit and marginal adaptation. Avoiding the above-mentioned steps may lead to fabrication of the FPD with hampered quality. Inability of the prosthesis to sit over the prepared tooth margins and adapt to it may inhibit routine hygiene procedures and encourage dental caries and gingival inflammation.¹² Even the most ideal and suitable case selected for FDP may fail in due course of time if the above laboratory steps were not followed adequately.

Risk of respiratory infections and berylliosis in lab technicians using beryllium containing alloys in dental prosthesis fabrication have been reported earlier.¹³⁻¹⁵ Since then, there has been a continuous emphasis on use of beryllium free alloys in dental practice. The present survey recorded 38.1 % laboratories using beryllium free alloy in their laboratories and the same had knowledge about berylliosis. This result shows the lack of knowledge and awareness amongst dental technicians towards risk factors related to their own health. Other important aspect covered in the survey were whether or not having a separate ceramic room with proper temperature control and ventilation. Also, whether the laboratories were reusing the sand in sand blasting unit and regularly calibrating the ceramic firing unit. All these questions had a similar response pattern. The overall analysis of the results of this survey suggest that approximately half of the laboratories who participated in the study were not following the routine laboratory procedures and steps required in the fabrication of FDP. This can be considered as one of the major causes of increased failure rate of fixed dental prostheses in a short duration of time. Working with more caution would largely reduce the FDP failure rate in future.

CONCLUSIONS

Within the limitations of this survey study, it can be identified that there is inadequacy of knowledge about the basic laboratory procedures used in fabrication of FDPs amongst the lab technicians. Emphasis should be given on use of appropriate procedures in fabrication of FDPs in dental laboratories so as to improve the quality of work delivered by the laboratories. Evaluating responses given by the dental laboratory technicians in Western Maharashtra region in the survey regarding their knowledge about basic laboratory procedures in FDP fabrication, highlights their areas of

weakness. Avoiding such inadequacy in laboratories can significantly reduce FDP failure rates. Also, conducting workshops and continuing dental education programs for the dental laboratory technicians will help in enhancing their knowledge and even acquaint them with the newer techniques and advances in dental laboratory procedures.

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