

Evaluation of Knowledge and Attitude towards Alginate Impression Material among Dental Care Providers at King Abdulaziz University Dental Hospital (KAUDH)

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Abstract

Introduction: Alginate impression material is one of the most widely used dental materials in daily clinical practice for diagnosis, pre-treatment planning, post treatment records and construction of dental prostheses and appliances.

Objective: To evaluate the knowledge and attitude towards storage, handling and waste management of alginate impression material among dental care providers at King Abdulaziz University Dental Hospital (KAUDH).

Methods: Excess of alginate impression material was collected over a period of ten working days from the departments of orthodontic, prosthodontics and restorative dentistry at KAUDH. In addition, an online self-administered questionnaire was randomly distributed among 170 participants including undergraduate students, postgraduate residents and dental assistants. Responses were statistically analyzed using SPSS.

Results: The collected alginate excess recorded the highest quantity in prosthodontic and orthodontic clinics, while the response to the questionnaire showed that 53.1% of students and most of postgraduates and dental assistants stated that alginate was stored properly. The majority of participants reported the use of measuring scoops for powder, but less than half used measuring cups for water (45.4% students, 35.7% postgraduates and 33.3% dental assistants). Only 8.5% of students considered water temperature during mixing, while 50% of postgraduates and dental assistants do consider water temperature. Although more than 80% of participants rate their mixing of alginate as good to excellent, a significant number of participants (53.5%) reported their need to repeat the alginate mixing at least once, while 46.4% reported more repeats.

Conclusion: The findings of the current study suggest a significant waste of alginate impression material as evident by the high percentage of repeats reported by the dental care providers at KAUDH who participated in this study. Further investigation is required to confirm and establish a policy towards handling this material and controlling such waste based on a higher sample number to include more dental care providers.

Keywords: Alginate; Dental Waste; Dentist Attitude; Excess Alginate

Introduction

Impression materials are widely used in daily dental practice for diagnosis, treatment planning of cases requiring comprehensive orthodontic or prosthodontic treatment, construction of dental prostheses and orthodontic appliances as well as post treatment records [1,2]. Therefore, an important feature of any impression material is its capability to accurately record the desired anatomic areas of oral

tissues while maintaining dimensional stability [3]. Additionally, such material must be safe, inexpensive, biocompatible, easy to use and store as well as being durable [4]. Alginate is among the most widely used impression materials. However, the poor surface details reproduction and low dimensional stability renders it a material of choice in the fabrication of diagnostic casts [5]. Alginate impression material is supplied in a powder form to be mixed only with water thus adding the advantages of low cost and eliminating the need for complex equipment [4]. The alginate powder contains soluble sodium or potassium alginate, calcium sulfate as a reactor, trisodium phosphate, diatomaceous earth as filler particles, fluoride as an accelerator, sodium phosphate as a retarder and other minor elements, thus it must be stored in a proper environment in the absence of moisture or warm temperatures [6]. Two volumetric measuring scoops are usually provided by the manufacturer for precise measurement of both powder and water, as an exact ratio is necessary to ensure proper consistency and optimum properties. Setting and working time may be controlled by varying water temperature, but not the consistency of the mix. In addition mixing method can significantly affect the physical and mechanical properties of alginate impression materials, such as elastic recovery and tensile strength [7]. Centrifugal and vacuum mixing is superior to manual spatulation as they resulted in lower porosities both at the surface and internally [8].

Furthermore, improper mixing and handling of alginate impression material, where the manufacturers' instructions regarding powder water ratio and water temperature are not acknowledged, will result in undue waste generation. A phenomenon that is widely observed among dental clinics, especially undergraduate training programs institutions.

Amouei, *et al.* (2013) reported that the highest percentage of infectious and potentially infectious solid waste, including alginate impression material, was produced by the prosthodontic department. In addition, most of the general solid waste produced from the therapeutic centers is related to laboratory and prosthesis units [9]. Krishnappa, *et al.* (2015) assessed the quantity of different categories of waste generated among private dental practices in Bangalore and reported that infectious waste quantity was the highest among the different categories. They concluded that there is an urgent need to initiate a process to address this issue as there are no regulatory measures regarding waste minimization methods in developing countries [10].

Improper handling of dental waste has an impact on the environment causing pollution of water, air, and soil. It also considered a reason for the increased prevalence of blood borne infections [11]. Therefore, it is important to increase the awareness of all dental care providers to the various types of waste from the dental offices, their generation, segregation, collection and final disposal methods. Adhering to the manufacturers' instructions and adequate handling of impression materials will reduce infectious solid waste generation. The objective of this study is to evaluate the knowledge and attitude of dental care providers towards alginate impression material storage, handling and waste management of at King Abdulaziz University Dental Hospital (KAUDH) including undergraduate students, postgraduate residents and dental assistants.

Methods

This cross sectional survey was conducted at KAUDH, Jeddah, Saudi Arabia. Clearance from the Research Ethics Committee was obtained. Initially, the excess of alginate impression material was collected daily in plastic containers from the following clinical departments: orthodontics, prosthodontics and restorative dentistry clinical units including faculty and postgraduate clinics. The plastic containers were weight at the end of each day using a digital scale and record were made over a period of ten working days. Collection of excess alginate impression material from undergraduate students' clinical areas was not included in the study due to time limitation and the complexity of the comprehensive care sessions among fifth and sixth year undergraduate programs.

Data was collected from a brief self-administered online questionnaire. The participants in the questionnaire include fifth and sixth year undergraduate dental students, postgraduates in the masters program and clinical residency residents in the departments of orthodontics, prosthodontics and restorative dentistry as well as the dental assistants working in these departments. The questionnaire included the following demographic data: gender of the participants as well as the year of undergraduate students and the specialty for postgraduate residents. The participant's level of knowledge were then addressed by a series of questions including their attitude towards alginate impression materials storage, handling and wastage.

The collected data was analyzed using IBM SPSS version 23. A simple descriptive statistics was used to define the characteristics of the study variables.

Results

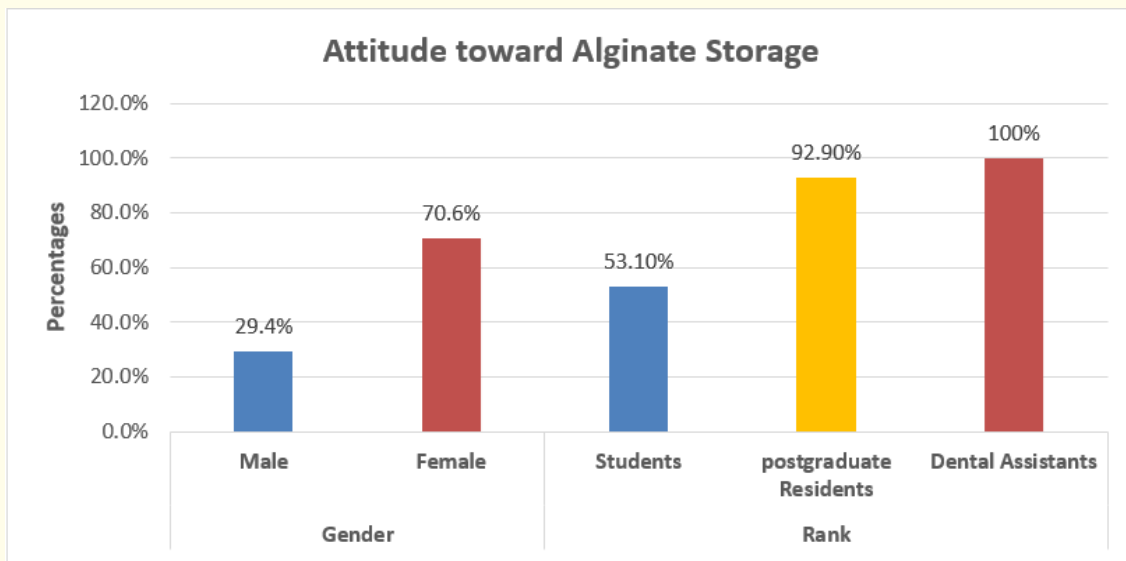
Data for the quantity of excess alginate impression material was collected over ten working days according to the related department schedule. The prosthodontics department recorded 1,144.6g from 22 patients, the orthodontics department recorded 1,030g from 18 patients, while only 130g was recorded from 3 patients in the restorative dentistry department (Table 1).

Day	Prosthodontic	No. of patients	Orthodontic	No. of patients	Restorative	No. of patients
1	235.6 gram	6	121g	2	29g	1
2	43g	2	0g	0	0g	0
3	0g	0	0g	0	48g	1
4	73g	2	624g	7	0g	0
5	204g	4	206g	5	0g	0
6	55g	1	0g	0	0g	0
7	75g	1	55g	2	53g	1
8	228g	3	21g	1	0g	0
9	231g	3	3g	1	0g	0

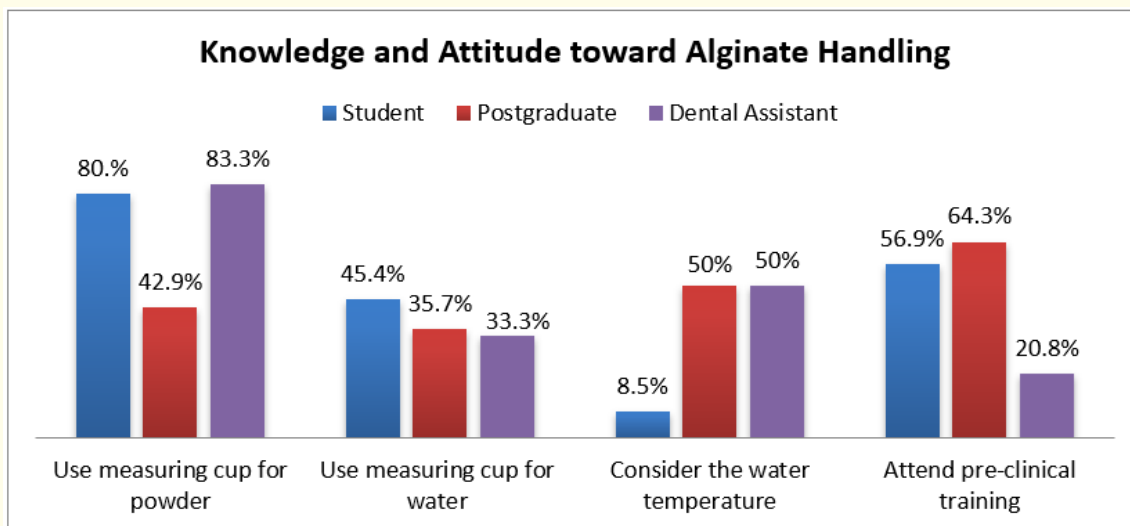
Table 1: Quantity of collected alginate excess per department.

The results of the self-administered online questionnaire showed a total number of participants of 170, 120 were female (70.6%) compared to 50 male (29.4%) distributed as follows: 130 were undergraduate, dental students, 16 postgraduate residents and 24 dental assistants. 63% of the participants thought that alginate was stored properly while 37% of them disagreed. 27% of the participants who disagreed stated that the alginate was not stored in optimum conditions and listed conditions including temperature, humidity as well as infection control factors. 53.1% of undergraduate students, 92.9% of postgraduates and all dental assistants stated that the alginate was stored properly (Graph 1).

77.6% of participants reported using the provided scoops to measure the powder only while only 43.5% reported using the scoops for both powder and water measurement. Additionally, only 18.2% reported to consider water temperature during alginate mixing. 53% of all participants stated that they have received preclinical training for alginate mixing (Graph 2). When relating the use of measuring scoop to rank, the majority of participants reported the use measuring cup for powder, but less than half used it for measuring water (45.4% students, 35.7% postgraduates and 33.3% dental assistants). Only 8.5% of students considered water temperature during mixing while 50% of postgraduates and dental assistants consider water temperature. In addition, more than half of students (57%) and postgraduates (64%) have received pre-clinical training including alginate impression material mixing as an essential requirement before starting their clinical work at KAUDH.

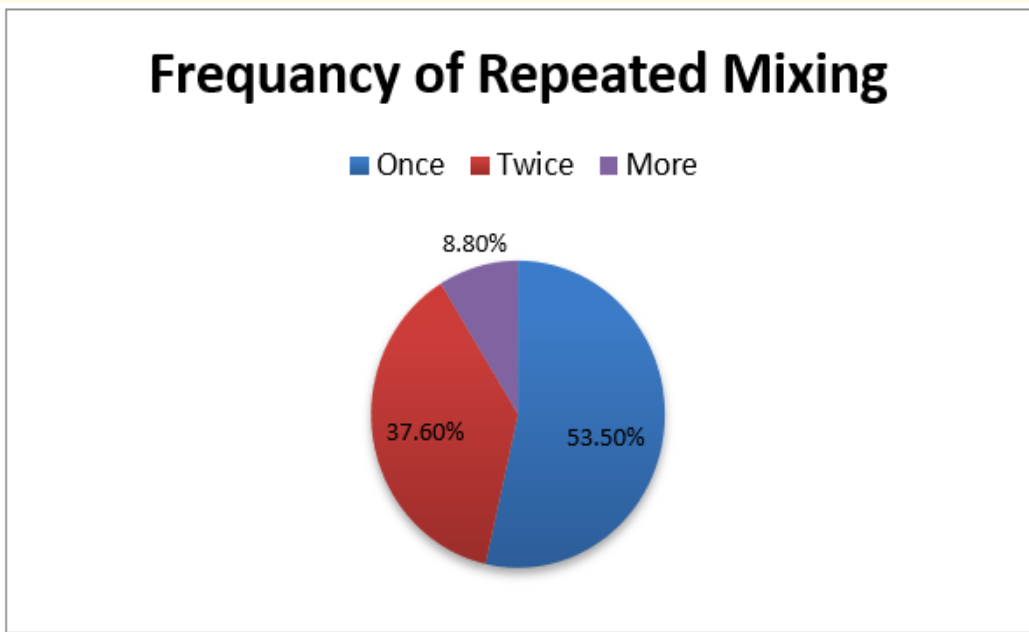


Graph 1: The attitude towards the storage of alginate according to gender and rank.



Graph 2: The knowledge and attitude toward Alginate Handling in relation to rank.

Only 12.4% of participants rated their mixing performance as poor while the majority of the participants (87.6%) rated their mixing as good to excellent. A high number of participants (53.5%) stated that they usually need to repeat the alginate mixing at least once while 46.4% repeat it more than frequently (Graph 3).



Graph 3: The frequency of repeated mixing.

Discussion

The highest amount of alginate material excess was recorded from orthodontics and prosthodontics clinics due to the immense need for diagnostic casts fabrication for larger number of patients in those departments compared to the need to make such impressions in the restorative dentistry clinics. Dental impression materials waste constitute a large percentage of the total waste produced by dental clinics [12,13]. The introduction of digital technology in dentistry offers many advantages including storage space and reduction of produced waste. The precision of intra oral scanning and the virtual 3D models provides an excellent alternative to conventional impression methods and casts fabrication. Such method will reduce the need to use impression materials for diagnostic purposes as well as eliminating the need for repetition of impression material mixing [14].

The measurement of alginate waste in the undergraduate students clinics proved to be challenging due to time restriction and the characteristic of the comprehensive care clinical sessions, thus, the use of an online self-administered questionnaire was implemented and proved to be an efficient surveying tool.

70% of the respondents to the questionnaire were females. This was expected as there are higher number of female personnel working at KAUDH and especially as dental assistants. KAUDH is a teaching hospital associated with the Faculty of Dentistry at King Abdul University (KAUFD) where most of the clinics are occupied by undergraduate dental students. The dental assistants are responsible for requesting, storing and supplying the alginate impression materials along with all other dental supply to the dental health care provider and practitioner. The ratio of dental assistant in undergraduate clinics is 1:6 and in postgraduate training clinics is 1:1 and the dental assistants are usually the ones mixing the alginate for the consultants as well as the residents. They may also assist undergraduate students in mixing the alginate in case if repetition. Hence, the number of dental assistants' participants in the current study was higher than the postgraduate residents.

37% of participants believed that alginate was not stored properly, 27% of these listed high temperature, humidity and infection control as factors. KAUDH infection prevention and control department reported a higher incidence of alginate mishandling by undergraduate dental students compared to other ranks which included storing alginate in unlabeled plastic containers, using wet measuring scoops, as well as placing the mixing spatula inside the container.

Although around two thirds of the participants reported the use of measuring scoops for the powder, less than half reported the using scoops for measuring the water. This is critical as improper water measurement may lead to unsuitable consistency of the alginate mix and the need for repeat. Furthermore, the water ratio usually adversely affect the properties of the completed impression [15]. Additionally, the majority of participants (81.8%) did not consider water temperature during alginate mixing, despite its importance, as high water temperature especially in the summer season in Jeddah will lead to faster setting time and reduced working time [15]. Undergraduate dental students lack the experience and the training to complete an acceptable primary impression in a reduced working time which may be a reason for the increase in repeats among undergraduates.

More than half of participants 53.5% repeated and discarded alginate impression at least once which generates a large amount of waste. Although most of participants reported the need to repeat impressions, over 80% of the participants rated their mixing performance as good to excellent. Repetition might be related to improper practices, but not to inadequate training. The use of preloaded packages of impression material, using the provided scoops to measure the water needed, paying attention to the manufacturers' instruction and mixing protocols will not only improve the properties of the set impression but also reduce the quantity of waste generated. The use of automated mixing devices would probably ensure proper consistency, thus, reducing the time needed for mixing and the possible need to repeat a mix, in addition to improving the general mechanical properties and reduce the surface porosity in the resulting impressions [16].

Conclusion

The results of the current study highlighted the waste of resources mainly in alginate impression material as high repeats were reported by the dental care providers at KAUDH who participated in this study. Future investigation is needed to confirm and establish a policy towards controlling such waste based on a higher sample number and to include more dental care providers.

Recommendations

All dental care providers at KAUDH must follow the recommended guidelines in their clinical practice regarding alginate impressions including the use of measuring cup for mixing, considering water temperature and attending preclinical training programs to avoid repeating the impressions. Additionally, the provision of vending machines in the clinical areas may be useful in controlling the amount of alginate dispensed as well as ensuring proper storage conditions of alginate.

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