

The conduct of Dentistry undergraduate students with regard to the use and conservation of diamond burs for clinical practices

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ABSTRACT

The objective of this study was to examine the conduct of Dentistry undergraduate students regarding the use of diamond burs, as well as the conditions of the burs themselves. Questionnaires were applied to the 98 students regularly enrolled in the clinical subjects of the course (from the 7th to the 10th semesters) to evaluate the characteristics with regards to use, storing, sterilization, and conditions of the diamond burs used in clinical practice. The diamond burs were collected for analysis in an electron microscope (EM), where aspects related to their state of conservation were observed. Frequency calculations were carried out for the statistical analysis. It was found that 44.9% of the students stored the burs in isolation for sterilization; 27.6% used the same instrument for a period that varied from 1 to 2 years before discarding it; and 87.8% used the same instrument once or twice a week; 66.3% stated they did not use in clinic the same instruments used in lab activities; 73.5% used water, soap, and a brush to clean the bur, and 45.9% used gloves, cap, mask, and lab coats for this procedure; 51% used the air syringe to dry the bur; 39.8% did not disinfect them; 100% used autoclave; 87.8% reported good usage conditions; 59.2% had exchanged their instruments; and 81.6% agreed to use their own instruments in their oral cavity. The images from the EM show the structural loss of diamonds, the oxidation process of the bonding metal, and even the severe loss of the active part of the diamond tips. The students presented an adequate behavior regarding the storing, using, and sterilizing of the diamond burs. However, an analysis using the EM showed that the burs were not well preserved.

Descriptors: Dentistry Instruments. Dentistry Teaching. Sterilization. Scanning Electron Microscope.

1 INTRODUCTION

The National Curriculum Guidelines (DCN) of the Dentistry graduation courses state that the dental surgeon must have a generalist, humanist, critical, and reflexive formation, based on ethical and legal principles and in an understanding of the socioeconomic and cultural reality of their environment¹.

Teaching in service should place the dental surgeon in the inter-relation between social, technical, and scientific issues. Teaching clinics are environments in which the student gets in direct contact with their professional activities. The theoretical knowledge they acquire aids in the formation of diagnostics and in carrying out procedures, through a learning process that is based in gradually progressing practices, which are repeated until the student is capable of performing at the required levels²⁻⁵.

Among the practical exercises initially carried out in the pre-clinic, and later, in the clinic, adequate cavity preparation stands out, since it is essential in many aspects of dentistry clinic, especially with regards to Restorative Dentistry⁶. This stage requires the use of drills with diamond burs. Factors such as the heat generated by the rotation of the instrument, the use of dull instruments, overheating, excessive pressure, and the lack of refrigeration must be avoided to prevent operation sensitivity and damage to the pulp tissues⁷.

Dentistry students and professionals may neglect the maintenance of their instruments with an inadequate routine of cleaning and sterilization, which favors the accumulation of residues and the appearance of signs of corrosion and can also be provoked by the excessive use of these instruments. There are controversies in literature regarding the number of times a diamond bur can be used^{8,9}. Clinical practice is usually the guide that shows the adequate moment to discard these instruments¹⁰. However,

Ciccione et al.⁸ suggest that they should be discarded after three uses.

Students or even dental surgeons may not adequately follow the recommended guidelines for cleaning, sterilizing, and storing the instruments^{11,12}. Stress, hurry, overload, and fatigue are the most common causes for this negligence¹³.

The instruments must be rigorously cleaned, disinfected, and sterilized. A pre-cleaning must be carried out to make it easier to remove organic and inorganic residues, and after it, the instrument must be cleaned, dried, sterilized, and stored individually in closed storage spaces, protected from dust, humidity, and insects^{12,14}.

One must consider that the presence of residues, dental fragments, blood, saliva, and microorganisms affect the efficiency and wears diamond burs¹⁵. Therefore, rigorously following cleaning protocols, disinfecting and sterilizing, is not only in accordance to the norms of infection control, but also increases the lifespan of the drill¹⁶.

As a result, this research aimed to evaluate the conduct of students from the Dentistry course at the Universidade Federal de Campina Grande (UFCG), with regard to using the diamond burs in clinical subjects, while also analyzing the state of conservation of the drills that were about to be used.

2 METHODOLOGY

This research was approved by the Research Ethics Committee UFCG/2018 (CAAE: 76734017.1.00005182). The sample was selected according to the number of students regularly enrolled in the clinical disciplines (from the 7th to the 10th semester) of the undergraduate Dentistry course. Students participated after signing the Free and Informed Consent Form. Those who did not have with them a 1012 drill to be evaluated at the moment

of the draw were excluded. The drill examined should have been used at least once. There was a simple random sampling with a 5% error and an expected prevalence of 50%.

The study was divided in two stages (figure 1). In the first one, the students answered a questionnaire adapted from Soares et al. (2006)¹⁷, with questions regarding the use, storage, sterilization, and state of the diamond burs used in clinical practice.

In the second stage, three students from each semester were randomly chosen. The 1012 diamond burs they were going to use to care for the patients in the teaching clinic were collected and they received another to use instead. The

instruments collected were individually stored and tagged, not to interfere in their conservation conditions. They were later evaluated by an electron microscope (EM) (Hitachi TM 1000), with a zoom from 150x to 500x. The microgeometry of the tips was analyzed considering distribution, morphology, and the size of the diamond granules.

The responses to the questionnaires were tabulated and analyzed in the statistical software SPSS (version 23.0). The results were presented in the form of graphs and/or tables and submitted to a statistical analysis with a calculation of their frequency. The results of the EM were analyzed by comparison.

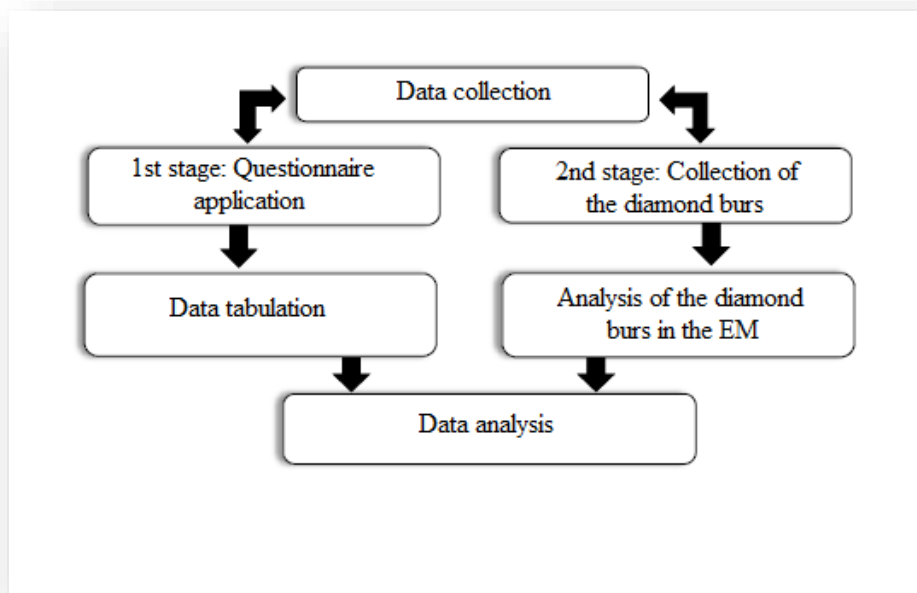


Figure 1. Flowchart with the stages of the development of the research

3 RESULTS

The research included 98 participants, in accordance to the sample calculation. Among

them, 29 were students from the 7th semester, 22 from the 8th, 27 from the 9th, and 20 from the 10th.

After the analysis of the answers of the questionnaires, it became clear that, when asked about the means they used to store the diamond burs before sterilization, 41.4% of 7th semester students, 50% of 8th semester students, and 55.6% of 9th semester students answered that they use individual storage, while 50% of students in the 10th semester stated to use metallic bur organizers.

Regarding how long they had been using the diamond burs, most students (44.8%) in the 7th semester stated to have been using them for 3 to 6 months; 31.8% of the students in the 8th semester stated that they had been using them for 1 to 2 years; 37% of those in the 9th semester had been using them from 7 to 11 months; and 50% of those in the 10th semester had been using them for more than 2 years.

Concerning how often they use the diamond burs, 96.6% of students in the 7th semester, 63.6% in the 8th, 88.9% in the 9th, and 100% in the 10th period stated to use these instruments once or twice a week. The next question was regarding whether the diamond burs used in clinical practice were the same used in laboratory disciplines. 62.1% of students in the 7th semester, 72.2% in the 8th, 59.3% in the 9th, and 75% in the 10th answered no.

Regarding the specialty in which they used the diamond burs the most, 72.4% from the 7th, 50% from the 8th, and 80% from the 10th answered Cosmetic Dentistry. The students in the 9th semester, though, stated that Prosthetics is the field in which they use diamond tips most often.

Regarding how to clean the burs, 69% of students from the 7th semester, 72.7% from the 8th, 77.8% from the 9th, and 75% from the 10th semester cleaned them using water, soap, and brush. 51.7% of the students from the 7th semester stated to used procedure gloves, cap, mask, coat, and safety glasses to do so, while 50% of the students from the 8th semester, 51.9%

from the 9th, and 50% from the 10th do not use the glasses.

Regarding procedures carried out after cleaning and/or disinfecting, 58.6% of the students from the 7th semester answered they dry their instruments with absorbing paper, while 50% from the 8th semester, 63% from the 9th, and 60% from the 10th dry theirs with an air syringe.

Regarding the way they usually disinfect the diamond burs, 34.5 from the 7th semester stated to use glutaraldehyde for ten minutes, while 34.5% stated not to do any disinfection procedures. 50% of the interviewees from the 8th semester do not disinfect their instruments, which is also true for 37% from the 9th semester and 40% from the 10th.

Regarding the sterilization of the diamond burs, 100% of students used an autoclave. When asked about how they evaluate the conservation condition of their diamond burs, 93.1% of students from the 7th semester, 90.9% from the 8th, 92.6% from the 9th, and 70% from the 10th declared that their instruments were in good condition.

When asked about whether they had ever replaced the diamond burs with which they started attending patients, 55.2% of participants from the 7th semester said they did not, while 63.6% from the 8th, 66.7% from the 9th, and 65% from the 10th stated they had replaced their diamond burs at least once.

Finally, they were asked whether they would allow the use of these diamond burs in their own teeth. 93.1% from the 7th semester, 63.6% from the 8th, 85.2% from the 9th, and 80% from the 10th stated that they would. The general numbers for the Dentistry course, for each question asked, is in table 1.

Regarding the EM results, the images show the structural loss of diamonds, the oxidation process of the bonding metal, and even the severe

loss of the active part of one diamond tip from the 10th semester (figure 2).

Table 1. Frequency of the main responses considering the total sample size

QUESTION	MAIN ANSWER	n (%)
How do you store the diamond burs when they are not sterilized?	Individual storage	44 (44.9%)
How long have you been using this diamond bur?	1 to 2 years	27 (27.6%)
How often do use this diamond bur?	1 to 2x a week	86 (87.8%)
Is this the same bur you used in pre-clinic studies?	No	65 (66.3%)
In which discipline do you use this bur the most?	Cosmetic dentistry	69 (70.4%)
How do you clean this bur?	Water, soap, and brush	72 (73.5%)
When you do the cleaning, what do you wear?	Procedure gloves, cap, mask, and coat	45 (45.9%)
Do you do any procedures after cleaning and/or disinfection?	Drying with the syringe	50 (51%)
How do you disinfect the diamond bur?	None	39 (39.8%)
How do you sterilize the diamond bur?	Autoclave	98 (100%)
Do you think your diamond bur is in a good condition to be used?	Yes	86 (87.8%)
Have you ever replaced the diamond bur after you started attending the patients?	Yes	58 (59.2%)
Would you use this diamond bur in your own teeth?	Yes	80 (81.6%)

4 DISCUSSION

Dental surgeons and their patients seek an adequate attention, which associates health and a harmonious smile¹⁸. The knowledge of materials and techniques to be used, such as diamond burs for cavity preparation, are factors that contribute for a successful treatment⁵.

The diamond burs used by the undergraduate students in this research, when not sterilized, were stored separately, different from what was found by Soares et al. (2006)¹⁷ in a study in which 67% of students kept their tools in a metallic bur organizer. Surgical level storing, according to the Ministry of Health¹⁹, promotes the protection of the articles and makes it

possible for the sterilizing agent to penetrate the package when the tool is submitted to sterilization, guaranteeing that the tool will be kept in sterile condition until its next use.

In this study, 27.6% of participants had used the same diamond bur for 1 to 2 years, using it as frequently as once to twice a week (87.8%). When they choose the diamond burs to be used in their activities, they must consider the lifespan of the tool, considering qualitative properties such as the efficiency of the cut and the maximum wearing of the structure in a lower period of time and with lower effort⁹. The lifespan is considered according to the time and the way in which the instrument is used¹⁵.

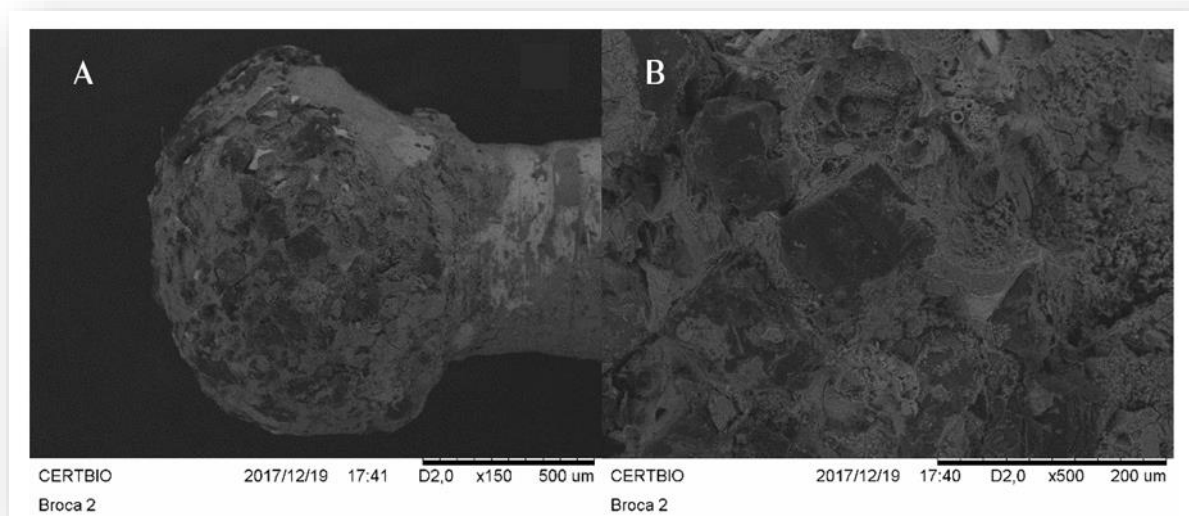


Figure 2. Photomicrographs of the drill of a 10th semester student showed a severe loss in part of the active bur, when the image was zoomed 150x (A) and 500x (B).

Regarding which specialty requires the drill the most, 70.4% answered Cosmetic Dentistry, probably due to the features of this instruments, which can be used for precise cuts and have the necessary tactile controls to create conventional cavity preparation. With the advent of Restorative Dentistry, which prescribes that the intervention and wear-and-tear should be as little as possible, the use of burs with these features is increasingly encouraged²⁰. It should be highlighted that the diamond burs are widely used in other specialties, such as Prosthetics, Pediatric Dentistry, and Endodontics.

The pre-cleaning disinfection increases the efficacy of the process of sterilization or disinfection, making it easier for them to act on the surface of the instruments. This stage was neglected by 39.8% of students, a better result than the one found in other studies, one which found that 59.2% of students did not carry out this procedure¹², and another in which there was 94% negligence by Dentistry undergraduates²¹.

Disinfection is known to minimize the contamination and is an essential step before sterilization^{22,23}. Therefore, all students should execute this important stage in the sterilization of their instruments.

When diamond burs are used, many particles become lodged between the diamond granules, and as a result, these instruments require an efficient cleaning for their performance to be guaranteed¹⁸. In this study, it was found that 73.5% of students use water, soap, and a brush to clean the diamond burs. Despite being a recognized method to clean instruments, there are other, more efficient ones. The use of ultrasound in the cleaning of endodontic files forms bubbles that move and implode, creating a vacuum that increases the effect of brushing, indicating that it is more effect to associate the ultrasound with the cleaning with water, soap, and a brush²⁴.

In Dentistry teaching clinics, the measures of prevention and infection control are very

important in the clinical development²⁵. Paiva et al. (2017)¹³ find that 50.8% of the occupational accidents in Dentistry were more serious injuries, such as the exposure of non-intact skin to biological materials, the exposure of the mucosa, and perforations. Therefore, one must be attentive to the accidents with sharp materials involving students, minimizing the risks of occupational hazards²⁶, especially during pandemics.

In this study, the percentage of students who clean their instruments using gloves, cap, mask, and coat calls attention (45.9%), followed by those who use the same equipment, but also use safety glasses (31.63%), to the detriment of the rubber gloves, which were only used by 17.34% of them. This result is similar to those of other studies^{15,21}.

Apart from the attention to the patient itself, the highest number of occupational accidents take place when the instruments are being cleaned, and the objects that lead to the highest percentage of accidents are the drills²². When the cleaning is done manually, cleaning is a potential hazard, and the use of specialized equipment to carry out this procedure is recommended, in order to eliminate the possibility of incidents²². In the absence of these equipment, one can use rubber gloves as protection. According to the Ministry of Health¹⁹, although these do not protect the user from perforations, they can diminish the contact with blood, and should be used as a personal protective equipment during the cleaning of materials.

Continuing the stages of instrument cleaning, drying them with the air syringe was the method of choice of 51% of students. This stage diminishes the possibility of corrosion and can be done with a clean and dry tissue, with a hot/cold air drier, or with a heating chamber regulated for this purpose¹⁰, which diminishes

the formation of aerosols.

It was found that all students used the autoclave to sterilize the burs. This is the most effective and practical method of sterilization. Some authors^{16,27} found a diminution in the cutting performance of the diamond burs that went through the autoclave process. Additionally, sterilization may cause structural changes in the diamond burs, such as the presence of corrosion and the loss of diamond granules. However, this procedure is indispensable for instruments that are under contamination hazards, such as the diamond burs²¹.

When asked about the conservation condition of the diamond burs, 87.8% of the undergraduates in this study stated that their instruments were in good working conditions. According to the analysis of the questionnaires, 84.9% considered their diamond burs to be in a good condition for clinical use. Similar data was found by Oliveira et al. (2015)¹⁵. On the other hand, Soares et al. (2006)¹⁷ found that 87.5% of their interviewees also considered their instruments adequate, despite the fact that this was not coherent with the microscopic assessment carried out, which showed corrosion, loss of the cutting capabilities, and of diamonds in the active bur. In this research, the images from the EM show significant signs of wear, characterized by the structural loss of diamonds, the oxidation process of the bonding metal, and even the severe loss of the active part of these diamond burs. It should be highlighted that, for the graduates, the bur was adequate for use and in a good conservation condition, showing that the judgment of the students with regards of their instrument is mistaken. They even use these instruments in patients in their clinical practice, which can lead to undesirable outcomes.

In this research, 81.6% of the students stated that they would allow this instrument to be

used in their own mouths. These results are similar to the one found by Soares et al. (2006)¹⁷, in which 70.72% of students would accept the use of their instrument in their own oral cavity. However, the number of students who would not is considerable, showing how important it is to motivate the students to adopt the adequate conditions to guarantee an optimal clinical practice¹². According to Pimentel et al. (2012)²¹, it is important to adhere to more rigorous protocols in the academic units, so that students adopt them both in their university formation and in their professional lives.

5 CONCLUSION

The Dentistry students presented an adequate conduct regarding the storing, using, and sterilizing of the diamond burs, in accordance to the prescriptions found in literature. However, an analysis using the EM showed that the tips were not well preserved.

ABSTRACT

Conduta de graduandos em Odontologia em relação ao uso de pontas diamantadas

O objetivo do estudo foi conhecer a conduta dos graduandos de Odontologia em relação ao uso de pontas diamantadas e suas condições de conservação. Foram aplicados questionários aos 98 acadêmicos regularmente matriculados nas disciplinas clínicas do curso (7º ao 10º períodos), a fim de avaliar as características sobre uso, armazenamento, esterilização e condições das pontas diamantadas utilizadas na prática clínica. Pontas diamantadas foram recolhidas para análise em microscópio eletrônico de varredura (MEV), onde foram observados aspectos relativos ao seu estado de conservação. Foram realizados cálculos de frequência para análise estatística. Observou-se que 44,9% dos estudantes utilizavam empacotamento individual para proceder a esterilização; 27,6% usavam o instrumento por um período de 1 a 2 anos até o seu descarte e 87,8% usavam o mesmo instrumento de 1 a 2 vezes por semana; 66,3%

afirmaram que não utilizavam nas clínicas os mesmos instrumentos empregados em atividades laboratoriais; 73,5% empregavam água, sabão e escova para lavagem e 45,9% utilizavam luva de procedimento, gorro, máscara e jaleco; 51% empregavam seringa de ar para secagem; 39,8% não faziam desinfecção; 100% utilizavam autoclave; 87,8% relataram boas condições de uso; 59,2% já trocaram seus instrumentos e 81,6% concordam em utilizar o próprio instrumento em sua cavidade bucal. Nas imagens do MEV pode-se observar perdas estruturais de diamantes, processo de oxidação do aglutinante e até perda severa de parte ativa dessas pontas diamantadas. Os graduandos apresentaram conduta adequada frente ao armazenamento, utilização e esterilização de suas pontas diamantadas. Entretanto, após análise em MEV as pontas não apresentavam bom estado de conservação.

Descritores: Instrumentos Odontológicos. Ensino Odontológico. Esterilização. Microscopia Eletrônica de Varredura.

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