

Where did that dental bur go? Patient Safety Lessons from a Dental Teaching Hospital

Para onde foi aquela broca dental? Lições de Segurança do Paciente de um Hospital Odontológico de Ensino

Shivaughn Marchan

DOI: <http://dx.doi.org/10.11606/issn.2317-2770.v29i1e-224159>

Marchan S. Where did that dental bur go? Patient Safety Lessons from a Dental Teaching Hospital. *Saúde, Ética Justiça (Online)*. 2024;29(1):e-224159.

ABSTRACT: Introduction: Ingested or aspirated dental burs have been reported in the literature. These events are akin to medical errors that can potentially cause patient morbidity or mortality and must be examined in the larger context of maintaining patient safety in dental settings. **Case report:** This work presents a case of an ingested bur and a near-miss event of a bur detached from a high-speed dental handpiece. Both cases occurred during the management of patients by students in a dental school setting. **Conclusion:** These cases are presented through the lens of patient safety. Conclusions are made on how organizational policies and curricula change can prevent such errors in the dental clinical training environment and mitigate patient morbidity or mortality.

KEYWORDS: Patient safety; Near-miss; Dental teaching clinics; Ingested bur.

The University of the West Indies, Faculty of Medical Sciences, School of Dentistry, Unit of Restorative Dentistry, St. Augustine, Trinidad e Tobago. ORCID: <https://orcid.org/0000-0002-1390-8937>

Correspondence: Shivaughn Marchan. E-mail: Shivaughn.marchan@sta.uwi.edu

Introduction

Patient care in dental schools is primarily provided by dental students of varying competence based on their stage of clinical training. At the international dental school described in this research, dental students begin clinical training in the second semester of the third year, while dental hygiene and therapy students begin clinical training in the first semester of the second year of training. The curriculum is competency-based, and clinical training happens in multi-disciplinary environments supervised by a mix of general practitioners and discipline-specific staff, normally in a ratio of one clinical supervisor to eight clinical dental students of varying competence¹. Direct supervision is provided; however, given the staff-to-student ratios, a clinical instructor is not with a student at all times. Given this scenario where students are not continuously directly supervised, the potential for unintentional patient harm exists².

At many dental schools, students are expected to execute various psychomotor tasks, such as the operative management of carious teeth, root canal therapy, and periodontal therapy, from the start of clinical training and given that pre-clinical laboratory training has been successfully completed. These procedures involve the use of dental handpieces operating at varying speeds with small cutting instruments called dental burs. Many other instruments used in routine restorative practice are small and can be easily swallowed or aspirated³.

In medical literature from the United States and the United Kingdom, medical error may be viewed and defined as unexpected errors made by clinicians or incidents in institutionalized settings that result in patient mortality or some degree of morbidity⁴. The use of the term error, in such literature does not necessarily mean medical negligence or have legal implications. It is in this context, that this work is presented. In complex organizational dental school settings, errors resulting in patient harm may be classified as active or latent⁵. Active errors are described as those caused by human factors within complex organizational settings⁶. In dental school settings, new dental students with minimal competence in many practical procedures and unfamiliarity with clinical rules and procedures can make mistakes and lapses in judgment when performing dental treatment. Non-existent controls or an organizational policy or rule not in place may cause latent errors within the clinical environment⁷.

This study describes the interaction of active and latent errors involved in the treatment of two dental patients; in one, physical harm was caused necessitating medical intervention and the other was a near-miss event. The presented cases highlight lessons that can be learned in dental clinical teaching hospitals

and practice settings from a patient safety perspective. A systems-based approach would foster a dynamic learning environment by meticulously scrutinizing and deconstructing errors caused by students in the institutional setting. This approach not only enhances the overarching accountability of the institution but also fortifies the individual practitioner's sense of responsibility⁴. Through this methodical analysis, a deeper comprehension of systemic flaws emerges, facilitating targeted interventions to rectify deficiencies and elevate performance standards⁴.

Case Report

Case 1

A third-year dental hygiene and therapy student was treating a medically fit 67-year-old female patient for caries in the mandibular arch. Dental hygiene and therapy students pursue undergraduate training in simple periodontal, operative, and preventive procedures at this institution. The student was working alone, without a dental surgery assistant or the high-volume suction assistance. Near the end of caries removal, the ½ round bur came loose from the student's handpiece and disappeared at the back of the oral cavity. The patient was initially unaware of what happened and was put into a sitting position on the dental chair from the prone position where dental treatment usually takes place. The student immediately reported the event to the supervising faculty, who temporized the tooth and arranged for the patient to be accompanied to the hospital's emergency room where the dental school was located.

Posterior-anterior radiographs of the chest and abdomen, taken within an hour of the incident, conclusively identified the bur was in the patient's stomach. The patient received instructions to examine her stool over a two-week period for signs of the bur in feces by defecating into a strainer and washing the feces. On the review appointment three weeks later, the patient reported the bur was not expelled. A follow-up radiograph confirmed the bur to be in the descending colon. Given the shape of the bur and the slow rate at which it was moving, it was believed the risk of intestinal perforation was high. At this stage, a colonoscopy examination was performed to exactly locate the bur in the natural constriction of the ileocecal valve and to preclude the clinical signs associated with bowel perforation. The bur was grasped, covered by a snare, and drawn towards the scope. The patient was placed on antibiotics for seven days and discharged as a same-day patient.

Case 2

A fourth-year dental student was treating a medically fit 38-year-old for caries in the mandibular

arch. The student was working alone, without assistance from a dental surgery assistant but with the patient manipulating the high-volume suction tip. The student had borrowed the handpiece from another student. At the start of the operative procedure, the 330 pear-shaped bur came loose from the student's handpiece, its whereabouts were unknown to the student.

The patient was immediately informed of what happened and was put into a sitting position for observation, and appeared normal with no coughing. The student immediately reported the event to the supervising faculty, who arranged for the patient to be accompanied to the emergency room. Plain film radiographs of the chest and abdomen, taken within two hours of the event, confirmed the bur was not in the patient's lung or gastrointestinal tract. The patient was discharged with no further instructions. Examination of the cuspidor traps failed to uncover the missing bur. Several days later, the housekeeping staff found the bur alongside the edge of the dental chair's stabilizing baseplate.

Discussion and Conclusions

Cases of ingested or aspirated dental instruments or prostheses are reported in the current literature⁸⁻¹⁰. Ingestion of dental instruments and prostheses is more likely than aspiration¹¹. The literature refers to such events as adverse events, however, they can also be considered preventable dental errors given that safeguards can be easily implemented and the subsequent medical implications of such events are significant with the medical care required to manage these events causing a financial burden to the dentist and the patient and the potential for malpractice claims to be initiated. While prompt medical intervention can reduce patient morbidity, the risk of death from aspirated dental devices exists¹².

It has been suggested that dental practitioners develop a systematic approach to ensure burs are securely attached to handpieces before use to mitigate detachment, which can present an aspiration or ingestion risk³. With friction grip dental handpieces, the loss of the bur is either associated with the bur not being fully seated or equipment malfunctioning.

Equipment malfunction during the operative procedure may be considered an error of commission, resulting in patient harm or potential harm. A retrospective examination of the handpieces in both cases concluded that faulty chuck mechanisms existed. In this case, the equipment malfunction could also be considered an error of omission due to a lack of preventive maintenance at regular intervals. The chuck is the portion of the handpiece turbine that holds the bur in place when

stationary or rotating¹³. In the first presented case, the student did not check if the bur was securely attached to the handpiece in the rotating position. In the second case, the student proactively checked to ensure the bur was secured in the handpiece while fixed and rotating; however, the bur came loose during its operation.

Many dental schools require students to purchase handpieces for individual use in the pre-clinical and clinical settings. Students at this school must maintain their handpieces to ensure optimum working efficiency. This entails liaising with technicians associated with local dealers of handpiece manufacturers. However, some students buy handpieces directly from online vendors with no maintenance facilities.

No school-driven policy requires proactive examination of the students' handpieces by their attending instructors or the school's technical staff to prevent equipment malfunction. This could be considered a combination of both active and latent errors resulting in adverse outcomes for the patient. Non-existent organizational policies where risk assessment of such events happening has not been considered and appropriate organizational rules not implemented, and the developing competence of novice students both played a role in these events⁵. Given that students, of varying competency, play a central role in patient management within the complex clinical environment, the failure of behaviors to proactively ensure the proper functioning of dental handpieces in the absence of policy resulted in the ingestion of a bur in one case and a near-miss event in the second case.

Pre-clinical laboratory teaching is meant to develop the psychomotor skills of students before clinical training. During this time, implicit learning objectives regarding the proper functioning of handpieces, how handpieces can fail, and the protocols for checking for faulty chuck mechanisms and protecting the airway must be covered. As students advance to clinical training, it is essential to continuously reinforce protocols for securing burs to handpieces and methods for protecting the airway, such as consistent use of rubber dam, to ensure the development of appropriate behaviors. This can be facilitated by using safety checklists for operative procedures similar to those used by medical surgeons¹⁴.

The ingestion or aspiration of a dental bur is only one type of incident in dental settings that could cause subsequent patient harm. The clinical curriculum should emphasize the various types of harm that can happen in dental settings and reinforce strategies to prevent the risk of aspiration or ingestion of dental burs and other devices. Policymakers, however, should develop and implement proactive policies to ensure that the dental school either proactively maintains dental equipment owned by students or require evidence of maintenance from third-party suppliers or distributors of such equipment.

Additionally, policymakers should advocate for a higher ratio of dental surgery assistants to those students who are new to the clinical setting and intend to use high-speed handpieces during patient care, given that in both instances the students did not have any chair-side dental surgery assistants. Organizational policies like these can mitigate errors related to ingested or aspirated burs and potential patient harm.

In any dental environment, the potential for dental bur aspiration or ingestion, particularly during training, underscores the critical need for proactive measures to prevent these incidents and minimize associated risks. The cases presented here highlight how active and latent

errors culminating in these events can be averted using simple safeguards. The curriculum must underscore the correct usage of dental burs, the importance of employing protective barriers to protect the airway, regular maintenance of handpieces, and readiness to handle such emergencies. Furthermore, institutions should strengthen safety protocols by adopting dental operative procedure checklists akin to the WHO surgery's safety checklist. Simultaneously, developing proactive policies ensuring the upkeep of dental equipment owned by students is essential. Finally, maintaining an optimal ratio of dental assistants and supervisors per student cohort ensures effective supervision and support.

Ethics and Consent: Written informed consent for publication of their clinical details was obtained from the patients.

Marchan S. Para onde foi aquela broca dental? Lições de Segurança do Paciente de um Hospital Odontológico de Ensino. *Saúde, Ética Justiça* (Online). 2024;29(1):e-224159.

RESUMO: Introdução: Brocas dentárias ingeridas ou aspiradas têm sido relatadas na literatura. Esses eventos são semelhantes a erros médicos potencialmente associados a morbidade ou mortalidade e devem ser examinados num âmbito mais amplo da manutenção da segurança do paciente no contexto odontológico. **Relato de experiência:** Este trabalho apresenta um caso de broca dentária ingerida e um caso em que a broca dentária se soltou de uma caneta de alta rotação. Os dois casos ocorreram durante o atendimento de pacientes por estudantes de uma Faculdade de Odontologia. **Conclusão:** Esses casos são apresentados sob a perspectiva da segurança do paciente. Conclusões são apontadas em relação a como as políticas organizacionais e mudança de currículo podem prevenir proativamente que tais erros aconteçam no ambiente de treinamento clínico odontológico e mitigar a morbidade ou mortalidade dos pacientes.

PALAVRAS CHAVE: Segurança do paciente; Quase acidente; Clínicas de ensino odontológico; Broca dentária ingerida.

References

1. Lynch C, Burke F. Quality of root canal fillings performed by undergraduate dental students on single-rooted teeth. *Eur J Dent Educ.* 2006;10(2):67-72. DOI: <https://doi.org/10.1111/j.1600-0579.2006.00397.x>
2. Marchan SM. Knowledge and perceptions of patient safety and patient safety culture in a dental school: a qualitative study [thesis]. Indianapolis, USA: American College of Education; 2023.
3. Abusamaan M, Giannobile WV, Jhavar P, Gunaratnam NT. Swallowed and aspirated dental prostheses and instruments in clinical dental practice: a report of five cases and a proposed management algorithm. *J Am Dent Assoc.* 2014;145(5):459-63. DOI: [https://doi.org/10.14219/jada.2013.552014;145\(5\):459-63](https://doi.org/10.14219/jada.2013.552014;145(5):459-63)
4. Rodziewicz TL, Hipskind JE. Medical error prevention. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019. [Accessed 2023 Dec. 28]. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK499956/>
5. Reason J. Human error: models and management. *Br Med J.* 2000;320(7237):768-70. DOI: <https://doi.org/10.1136/bmj.320.7237.768>
6. Rodziewicz TL, Houseman B, Hipskind JE. Medical error reduction and prevention. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2018. [Accessed 2023 Dec. 28]. <https://europepmc.org/article/NBK/nbk499956>
7. Voskanyan Y, Shikina I, Kidalov F, Musaeva S, Davidov D. Latent failures of the individual human behavior as a root cause of medical errors. In: Antipova T. (eds) *Advances in digital science. ICADS 2021. Advances in intelligent systems and computing.* Springer, Cham. 2021;1352:222-34. DOI: https://doi.org/10.1007/978-3-030-71782-7_20
8. Yadav RK, Yadav HK, Chandra A, Yadav S, Verma P, Shakya VK. Accidental aspiration/ingestion of foreign bodies in dentistry: a clinical and legal perspective. *Nat J Maxillo Sur.* 2015;6(2):144-51. DOI: <https://doi.org/0.4103/0975-5950.183855>
9. Iovino P, Di Sarno A, De Caro V, Mazzei C, Santonicola A, Bruno V. Screwdriver aspiration during oral procedures: a lesson for dentists and gastroenterologists. *Prosthesis.* 2019;1(1):61-8. DOI: <https://www.mdpi.com/2673-1592/1/1/8#>
10. Hou R, Zhou H, Hu K, Ding Y, Yang X, Xu G, et al.

- Thorough documentation of the accidental aspiration and ingestion of foreign objects during dental procedure is necessary: review and analysis of 617 cases. *Head Face Med.* 2016;12:1-8. DOI: <https://doi.org/10.1186/s13005-016-0120-2>
11. Tiwana KK, Morton T, Tiwana PS. Aspiration and ingestion in dental practice: a 10-year institutional review. *J Am Dent Assoc.* 2004;135(9):1287-91. DOI: <https://doi.org/10.14219/jada.archive.2004.0404>
 12. Kim E, Noh W, Panchal N. Mortality from an aspiration of dental crown during extraction. *Gerodontology.* 2017;34(4):498-500. DOI: <https://doi.org/10.1111/ger.12288>
 13. Little D. Handpieces and burs: the cutting edge [Internet]. Dentsply Styls. 2009. [Accessed 2023 Dec. 28]. Available at: Handpieces and Burs: The Cutting Edge (stylusatc.com)
 14. Saksena A, Pemberton MN, Shaw A, Dickson S, Ashley MP. Preventing wrong tooth extraction: experience in development and implementation of an outpatient safety checklist. *Br Dent J.* 2014;217(7):357-62. DOI: <https://doi.org/10.1038/sj.bdj.2014.860>

Received: 2024, April 15

Accepted: 2024, June 10