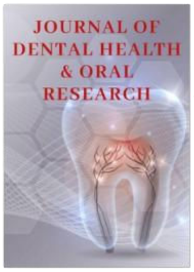

e-ISSN 3050-9432
Journal of Dental Health and Oral Research

ATHENAEUM SCIENTIFIC PUBLISHERS

Review Article

Influence of Repeated Use and Sterilization on the Performance of Diamond Burs: An SEM Study

Celso Afonso Klein Junior[1], Thaynara Piazza[2], Gilberto Timm Sari[1], Carine Soares[1], Luis Henrique Muller Pinto[1], Ahmet Ozkomur[1], Carlos Enrique Cuevas-Suárez[3*], Faisal Alsaid[4], Mohammad Qaddomi[4], Louis Hardan[5], Rim Bourgi[5,6,7*]

[1]Postgraduate Program in Dentistry, Universidade Luterana do Brasil (ULBRA), Canoas, Rio Grande do Sul 92425-900, Brazil

[2]Undergraduate student, Universidade Luterana do Brasil (ULBRA), Canoas, Rio Grande do Sul 92425-900, Brazil

[3]Dental Materials Laboratory, Academic Area of Dentistry, Autonomous University of Hidalgo State, San Agustín Tlaxiaca 42160, Mexico

[4]Esthetic and Prosthetic Dentistry, Faculty of Dental Medicine, Saint-Joseph University of Beirut, Beirut 1107 2180, Lebanon

[5]Department of Restorative and Esthetic Dentistry, Faculty of Dental Medicine, Saint-Joseph University of Beirut, Beirut 1107 2180, Lebanon

[6]Department of Biomaterials and Bioengineering, INSERM UMR_S 1121, University of Strasbourg, 67000 Strasbourg, France

[7]Department of Restorative Sciences, Faculty of Dentistry, Beirut Arab University, 115020 Beirut, Lebanon

***Correspondence author:** Carlos Enrique Cuevas-Suárez, Dental Materials Laboratory, Academic Area of Dentistry, Autonomous University of Hidalgo State, San Agustín Tlaxiaca 42160, Mexico and Rim Bourgi, Department of Restorative and Esthetic Dentistry, Faculty of Dental Medicine, Saint-Joseph University of Beirut, Beirut 1107 2180, Lebanon and Department of Biomaterials and Bioengineering, INSERM UMR_S 1121, University of Strasbourg, 67000 Strasbourg, France and Department of Restorative Sciences, Faculty of Dentistry, Beirut Arab University, 115020 Beirut, Lebanon;

E-mail: rim.bourgi@hotmail.com; cecuevas@uaeh.edu.mx

Citation: Junior CAK, et al. Influence of Repeated Use and Sterilization on the Performance of Diamond Burs: An SEM Study. J Dental Health Oral Res. 2025;6(2):1-12.

https://doi.org/10.46889/JDHOR.2025.

Received Date: 16-07-2025

Accepted Date: 29-07-2025

Published Date: 05-08-2025

Abstract

Diamond burs are essential in routine dental practice, with their longevity affected by factors including manufacturing quality, usage frequency, irrigation, applied pressure, and post-use cleaning and sterilization protocols. This study aimed to evaluate the wear characteristics and diamond particle retention of burs from three commercial brands-American Burs (American Burs Inc., Miami, Florida, USA), Kerr (Kerr Corporation, Orange, CA, USA), and KG Sorensen (KG Sorensen, Barueri, São Paulo, Brazil)-in comparison with single-use burs from Chongqing Xishan (Chongqing Xishan Science and Technology Co., Ltd., Chongqing, China) using Scanning Electron Microscopy (SEM). New burs (n = 5 per brand) were gold-sputtered and initially analyzed under SEM to assess the shape, size, and distribution of diamond particles. Each bur was then used to prepare cavities in bovine teeth under standardized conditions for pressure and irrigation. After each use, the burs underwent ultrasonic cleaning and autoclave sterilization. This cycle was repeated five times for each bur. Post-cycling SEM analysis revealed that KG Sorensen burs exhibited the least diamond wear, retained sharp cutting edges, and showed minimal particle loss. American Burs demonstrated moderate wear, rounding of edges, and partial diamond particle loss. Kerr burs showed significant wear, characterized by rounded abrasive surfaces and substantial particle detachment. In contrast, the single-use Chongqing Xishan burs lost nearly all diamond particles after one cycle, exposing the metal substrate. In conclusion, all multi-use burs tested—except the single-use variant—maintained their functional integrity through five clinical cycles. KG Sorensen burs exhibited superior wear resistance and durability, whereas the single-use burs failed to retain their abrasive capacity after the initial use.

Keywords: Cutting Efficacy; Diamond Bur; Diamond Tips; Scanning Electron Microscopy

Introduction

Dental burs have long been integral to clinical dentistry, particularly in facilitating tooth preparations. Initially, they were made of steel, then of tungsten carbide or silicon. The first diamond burs were developed in 1897 by Willman and Schroeder. They were manufactured using a copper or iron rod combined with diamond powder, allowing for more precise cuts in tooth enamel and a longer lifespan compared to silicon carbide burs. Inspired by engineering principles, these burs functioned as fixed cutting instruments permanently attached to the chuck, rotating at a torque of 5,000 to 10,000 rpm. However, in dentistry, clinical procedures required adaptation to significantly higher rotational speeds. Consequently, a specialized handpiece was developed to accommodate burs operating at speeds ranging from 25,000 to 400,000 rpm [1-3].

In 1932, a German industrialist named W.H. Drendel developed a new process for bonding diamond grains to a stainless-steel rod through electroplating, creating a diamond tip with exceptional resistance [4-5]. Due to the wartime shortage of steel, silicon carbide, and other abrasives, dentists had limited access to conventional tools. As a result, diamond tips being more durable and efficient became the only viable option for clinical procedures during the 1940s.

There are two methods of manufacturing diamond tips, the electroplating method and the Chemical Vapor Deposition (CVD) method. In the method of electroplating diamond grains onto a stainless-steel rod, it is necessary to add one or two layers of diamond grains that are fixed to a high-strength metal rod, such as stainless steel [5]. The second method, which is the most widely used today, is CVD. It involves the formation of a non-volatile solid film on a substrate through the reaction of gaseous precursors containing the desired constituents. This technique facilitates the direct deposition of fine diamond particles onto the rod, offering enhanced cutting efficiency, improved durability, and reduced risk of metal staining or contamination [5,6].

The selection of diamond grains used in burs varies by manufacturer and may involve either natural or synthetic particles, which differ in shape, size, and grit thickness. Natural diamonds tend to be more irregular and varied than synthetic ones, making them easier to deposit onto the bur's base structure. These differences result in burs with varying grain sizes and textures, directly affecting cutting efficiency and wear resistance. Grains are typically classified using mesh sieves with defined openings for each particle size, sorting them into categories such as superfine, fine, medium, and coarse [5]. However, this classification system is manufacturer- and batch-specific, as uniform particle size across all grains is highly improbable [7].

From a structural point of view, diamond tips are notoriously difficult to observe between their grains. Their structure becomes visible only through a Scanning Electron Microscopy (SEM) and it is for this reason that they tend to retain dental residues in the spaces between the diamonds, which makes it extremely difficult to completely remove all the particles of hard or soft tissue that are between the diamonds. When the spaces between the diamond particles become obstructed, the cutting power decreases, preventing the penetration of the diamonds into the substrate and causing resistance in the removal of dentin debris. In addition, it generates greater friction and heat for the dental organ, since the increased wear time of the diamond tip results from its ineffective wear capacity [6].

The chemical/physical cleaning process normally carried out by dentists is disinfection by chemical process associated with ultrasound, which can release debris that is between the diamonds [8]. The sterilization method standardized worldwide is sterilization with heat and pressure, in a wet form, using the autoclave [9]. Over the years, effective ways of cleaning diamond burs have been researched, always trying to find a 100% reliable method for removing dental debris that gets stuck between the diamonds and between the bur blades. However, all cleaning methods are unable to completely remove the dentin debris present between the diamonds, with ultrasonic cleaning being the most effective and having the least effect on the diamond grains [10]. A fundamental aspect to consider involves several factors that can affect diamond wear and potential displacement. These include high rotational torque, cooling flow, the pressure applied by the operator, the type of tooth structure or material being removed, as well as repeated use, cleaning, and sterilization processes [11-16]. Frequent use of diamond burs leads to a reduction in cutting efficiency when preparing dental tissue. This is likely due to the rounding of diamond edges, a decrease in particle size and the detachment of diamond grains from the metal shank [11]. Several factors contribute to this reduction in effectiveness, including the amount of force applied during tooth or restorative material preparation, the accumulation of substrate residues between the diamond grains—which increases frictional heat—and the natural loss of diamond particles along with the matrix material that holds them in place [12,17,18].

A significant difference is observed between the cuts made by new diamond burs and those that have undergone repeated use, cleaning, and sterilization in an autoclave. It has been shown that the cutting effectiveness of diamond burs decreases considerably after multiple cleaning and sterilization cycles [11]. Thus, the objective of this study was to perform SEM analysis to evaluate wear and diamond particle loss in diamond burs from three different commercial brands and one single-use bur, following cycles of cavity preparation, cleaning, and sterilization.

Materials and Methods

Twenty diamond burs were divided into four groups: three groups of reusable burs from different brands and one group of single-use burs. The reusable bur groups consisted of American Burs (American Burs Inc., Miami, Florida, USA), Kerr (Kerr Corporation, Orange, CA, USA), and KG Sorensen (KG Sorensen, Barueri, São Paulo, Brazil). The single-use bur group consisted of burs from Chongqing Xishan Science and Technology Co., Ltd. (Chongqing, China).

Each group consisted of five diamond burs, each placed in a numbered bur holder from 1 to 5. The burs were used in a standardized manner on bovine enamel and dentin. One bur from each group was randomly selected to serve as a negative control for SEM imaging. This control bur was used throughout the grinding procedure, and a final SEM image was taken afterward to serve as the post-use reference. Operator blinding was maintained throughout the study: neither the individual performing the cavity preparations nor the examiner analyzing the SEM images was aware of the brand of the diamond bur being tested.

Cavity Preparation

All diamond burs used in this study were applied on bovine teeth sourced from cattle slaughtered in the state of Rio Grande do Sul, Brazil. Five samples of healthy bovine permanent central incisors, extracted immediately post-slaughter, were utilized. These teeth, considered waste material from slaughterhouses, were kindly donated by Frigorífico do Sul, registered with the Ministry of Agriculture under number CISPOA/SISBI 274, as documented in the attached donation record. Therefore, this study did not involve any procedures requiring direct contact with live animals or humans.

The samples were stored in a plastic container including distilled water and refrigerated at 4°C. To perform the preparations, the teeth were embedded in an epoxy resin matrix to allow the sample to be fixed to a base. The high-speed handpiece was coupled to a computerized delineator-type device, already adapted for testing, in order to perform movements on the X, Y, and Z axes. Each diamond tip was used for the same time (15 s), with the same pressure (200g/cm^2), the same speed (3,000,000 rpm) and the same water irrigation, to perform the enamel and dentin preparations.

Each of the tested burs was used to perform a spherical preparation starting 2.0 mm from the cervical region of the bovine tooth and progressing toward the crown, with a total depth approximately equal to the diameter of the diamond tip. The preparation was completed after 15 s of continuous use. All five spherical burs were used on the same bovine tooth to ensure uniform testing conditions. For each subsequent wear cycle involving the same burs, a new bovine tooth was used.

Cleaning and Sterilization Cycles of Diamond Tips

At each use cycle, the diamond tips underwent ultrasonic cleaning for 15 min in a solution of water and enzymatic detergent (Riozyme IV and Neutro - Rioquímica). This detergent contains chemical agents such as proteases, lipases, and amylases, which aid in breaking down the organic debris present on the diamond tips. The tips were dried with an air jet for 5 min and packaged for a single autoclaving cycle (Cristófoli, single cycle of 121°C and pressure of 1.2 atm, total time of 1 hour and 2 min).

Scanning Electron Microscopy Analysis

For each group, one new diamond bur was randomly selected and used as a reference sample for SEM analysis. The bur was mounted on a stub and sputter-coated with gold according to standard SEM preparation protocols. Initial SEM images were taken to assess the surface characteristics and distribution of diamond particles before use. The same bur was then used for five standardized cavity preparation cycles, followed by cleaning and sterilization procedures after each cycle. After completing all five cycles, the bur underwent a second round of SEM imaging to evaluate the extent of wear and diamond particle loss. In the case of the single-use bur group, the designated burs were also subjected to five cycles of use, cleaning, and sterilization for comparison purposes, although these burs are not intended for reuse in clinical practice. SEM images were similarly obtained before and after the five cycles.

A Zeiss EVO10 SEM (Carl Zeiss Microscopy GmbH, Oberkochen, Germany) was utilized for the analysis. This instrument offers high-resolution imaging capabilities, with a resolution of up to 2 nm at 30 kV in secondary electron mode.

Results

All samples were examined at an accelerating voltage of 10 kV, using magnifications of ×110, ×300, and ×1000. At ×110 magnification, the new burs from KG Sorensen (KG Sorensen Indústria e Comércio Ltda., Barueri, São Paulo, Brazil) and American Burs (American Burs Inc., Miami, Florida, USA) displayed a higher density of diamond particles, which appeared more prominent compared to those observed in burs from Kerr (Kerr Corporation, Orange, California, USA) and the single-use bur (Chongqing Xishan Science and Technology Co., Ltd., Chongqing, China) (Fig. 1-4).

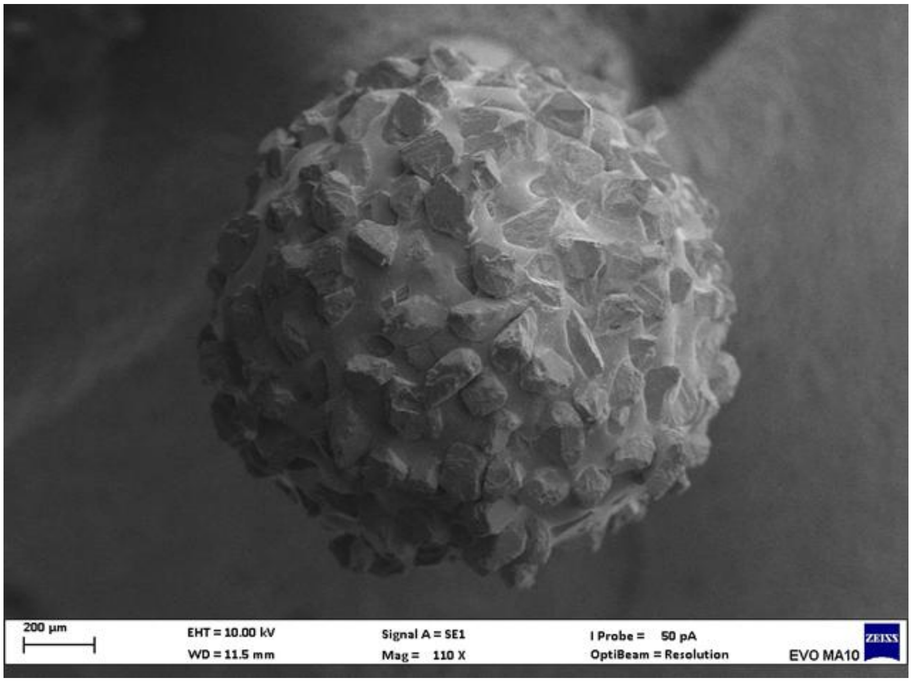

Figure 1: New KG Sorensen diamond bur.

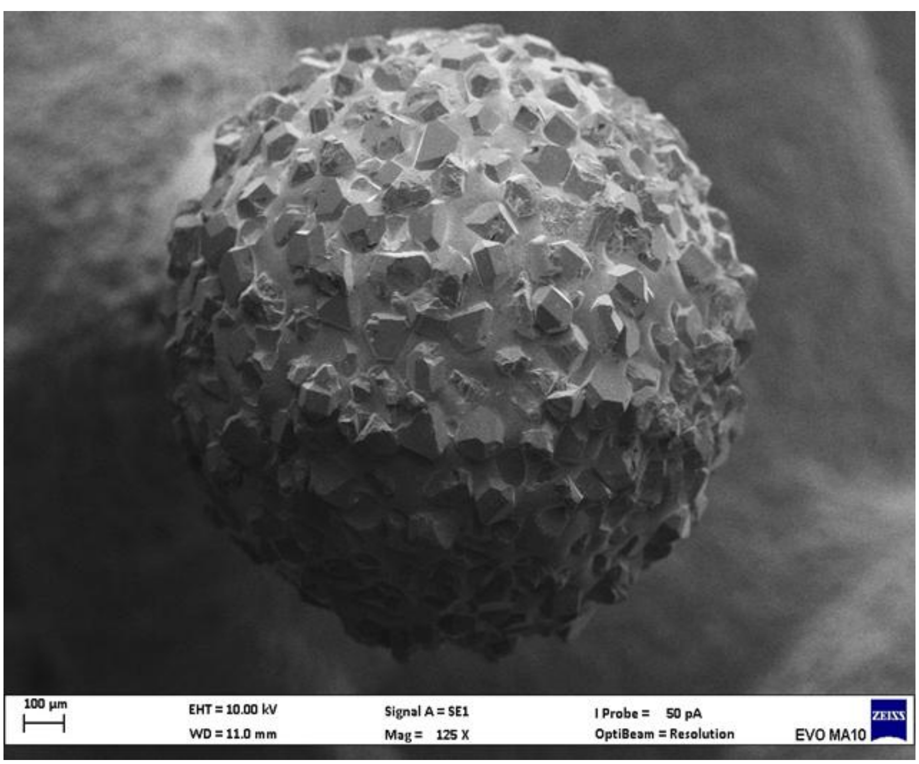

Figure 2: New American Burs diamond bur.

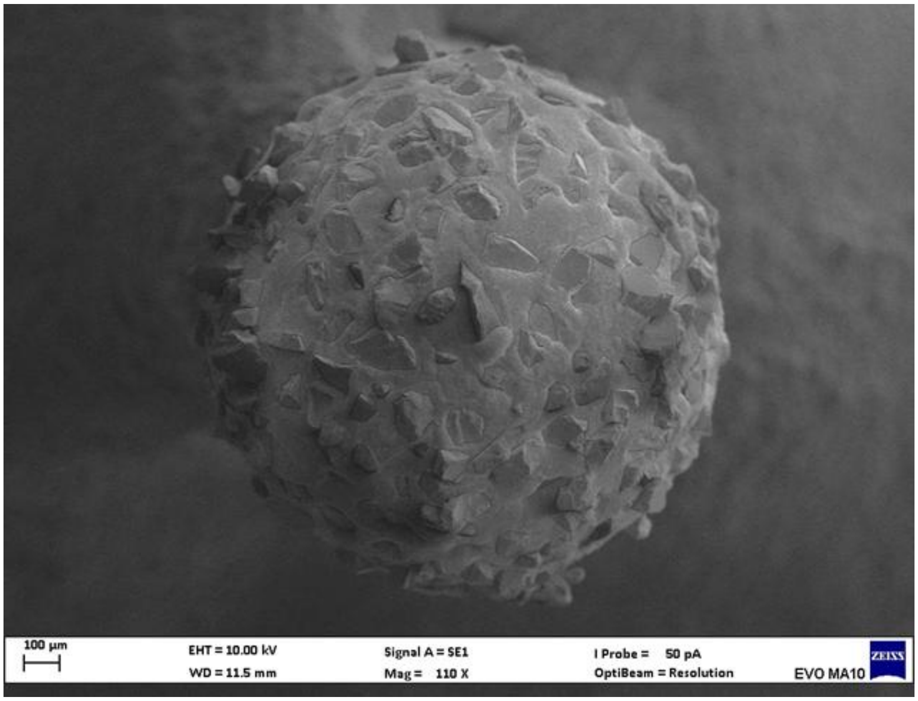

Figure 3: New Kerr diamond bur.

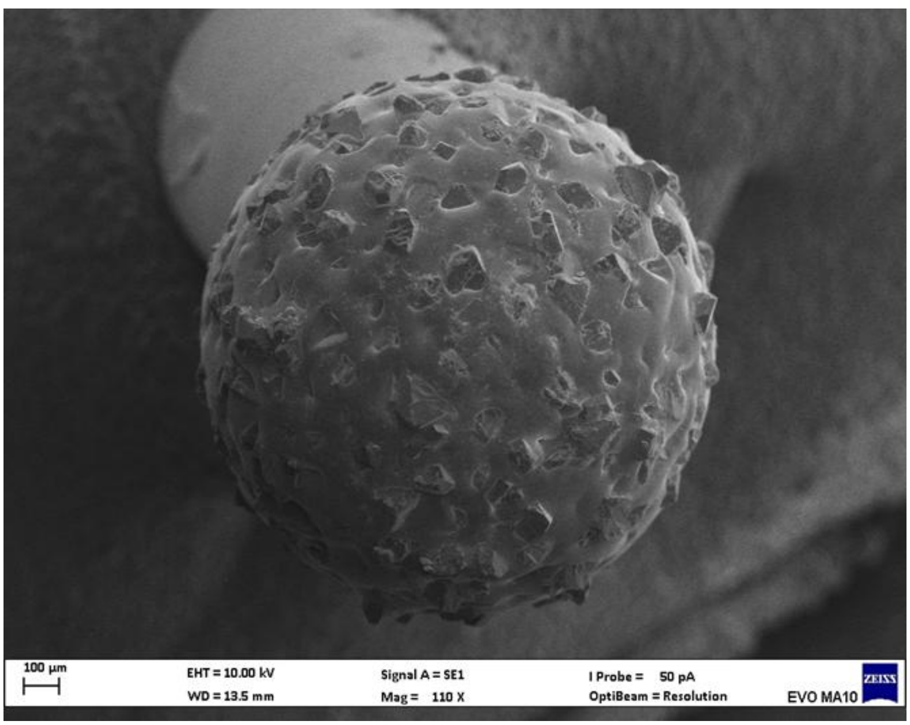

Figure 4: New single-use diamond bur.

At ×1000 magnification, the morphological characteristics of the diamond particles on the bur tips became evident. The burs from KG Sorensen and American Burs exhibited diamond particles with greater uniformity, well-defined edges, and a predominantly hexagonal shape, appearing prominently embedded in the matrix. In contrast, the burs from Kerr and the single-use group displayed particles with irregular shapes, poorly defined and often rounded edges, and lower overall prominence (Fig. 5-8).

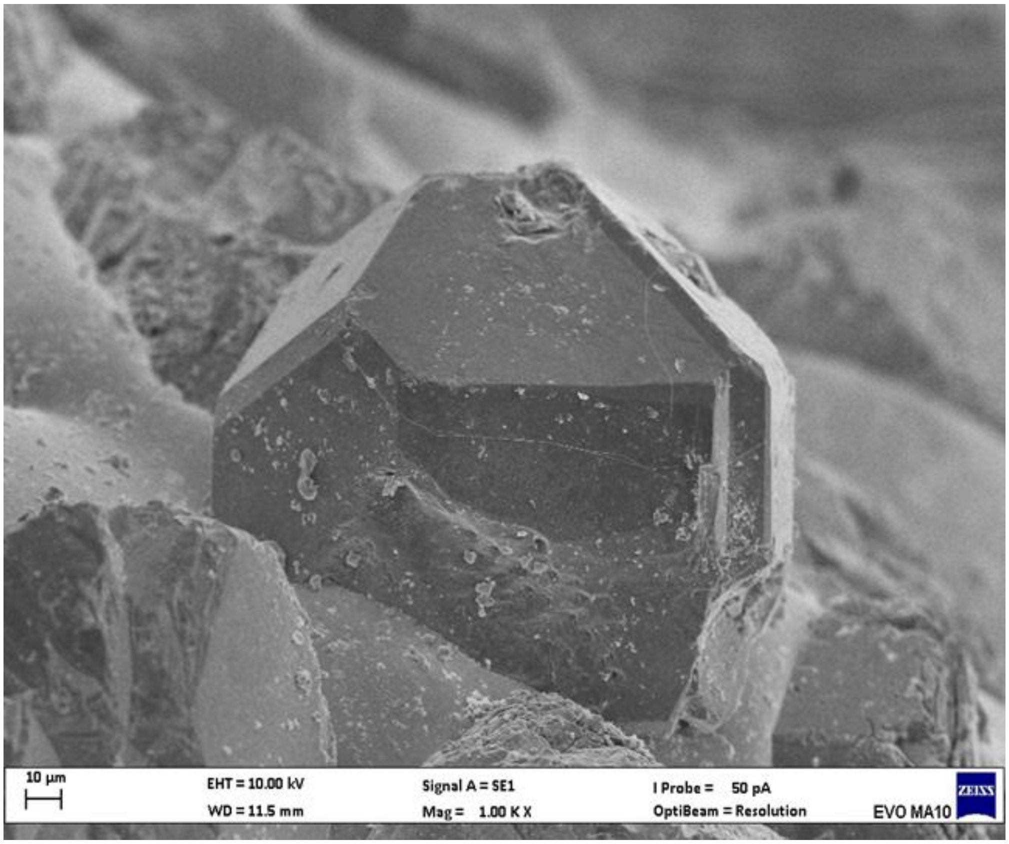

Figure 5: New KG Sorensen diamond bur.

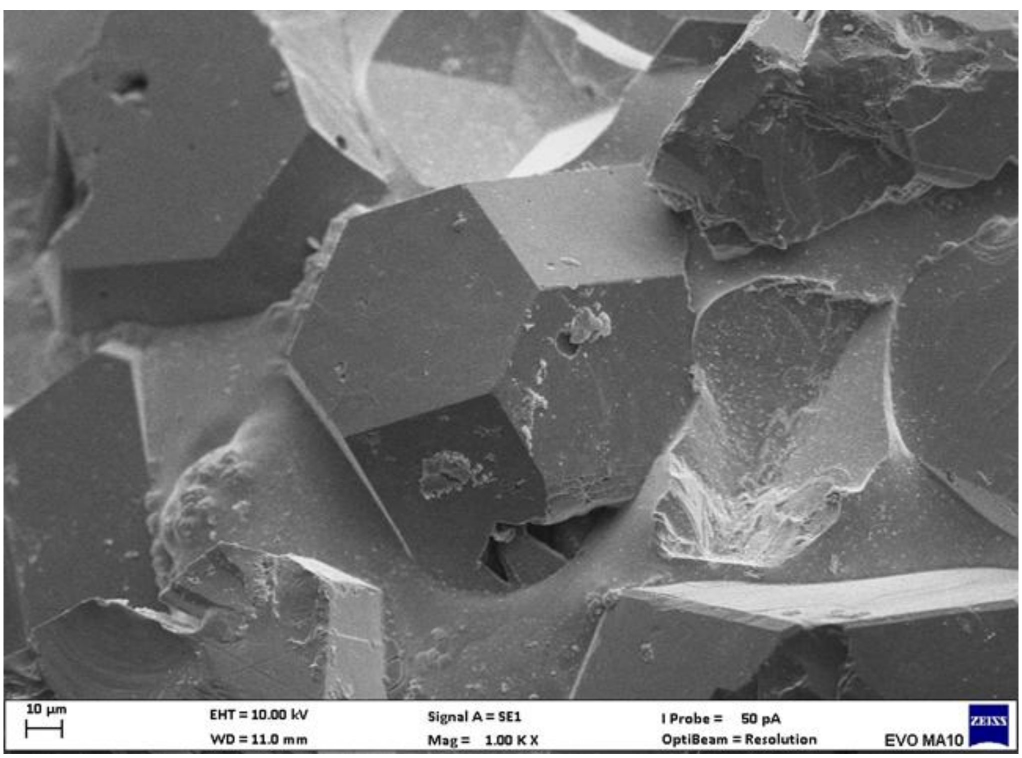

Figure 6: New American Burs diamond bur.

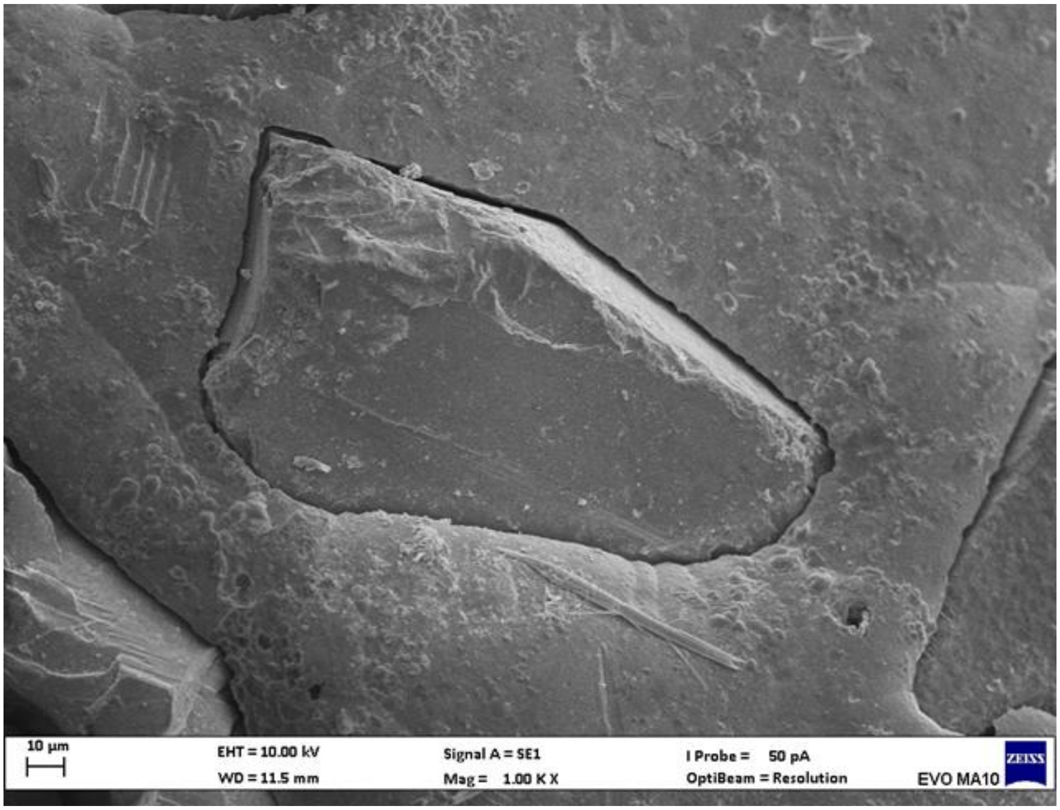

Figure 7: New Kerr diamond bur.

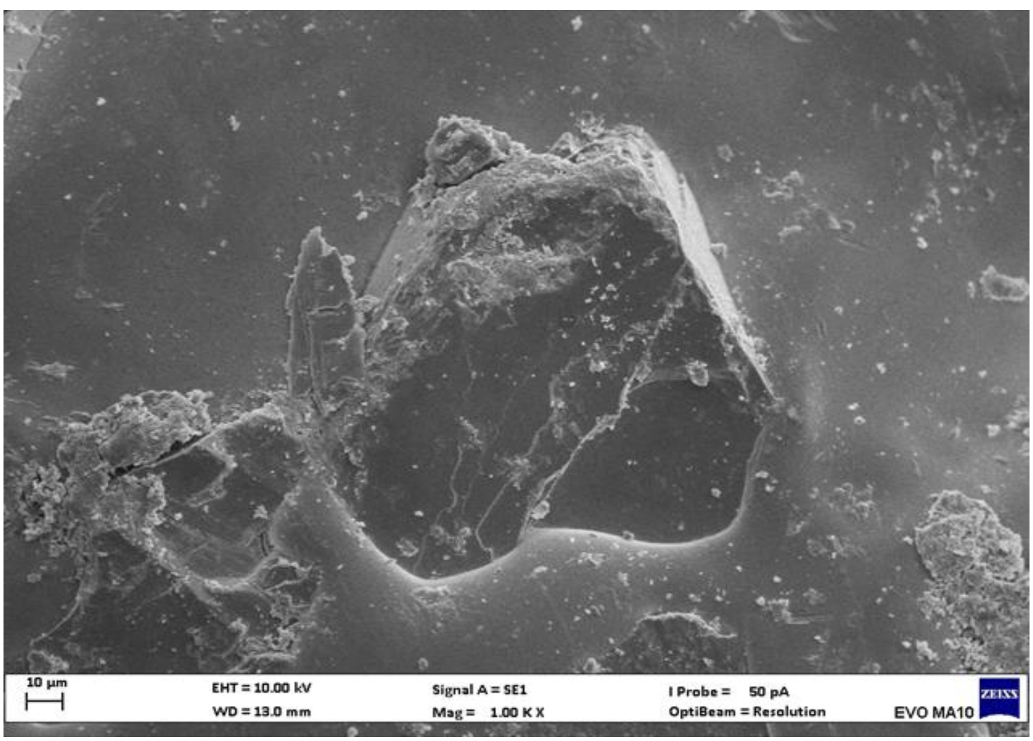

Figure 8: New single-use diamond bur.

When comparing new and used diamond burs at all three magnifications, a noticeable loss of diamond particles, rounding of edges, and both partial and complete detachment of abrasive grits were observed. Among the burs analyzed, the KG Sorensen burs demonstrated the least amount of diamond wear. These burs retained their cutting edges in a nearly intact and sharp condition, with minimal loss of diamond particles compared to the other brands (Fig. 9,10).

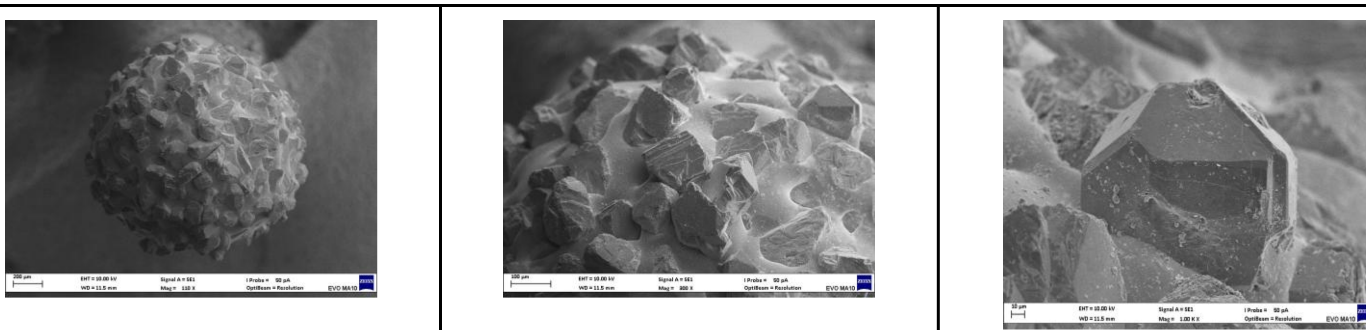

Figure 9: KG Sorensen new.

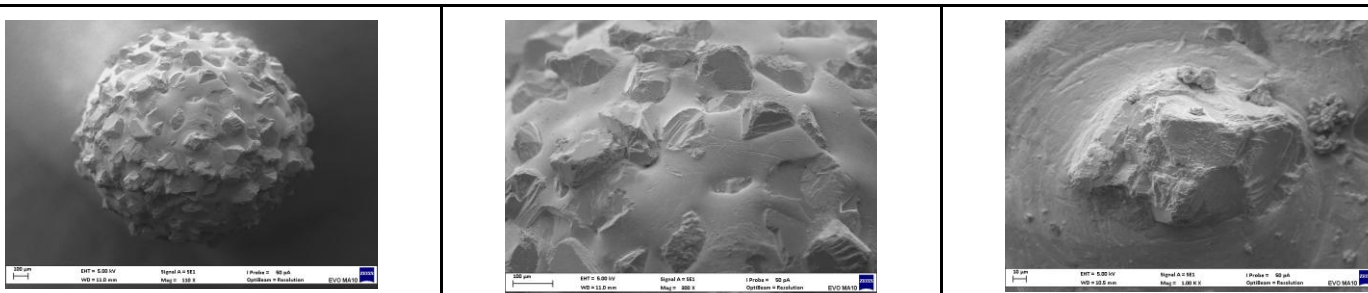

Figure 10: KG Sorensen used.

The burs from American Burs exhibited slight edge rounding in some diamond particles, along with minor fractures and surface wear. All five burs from this brand showed evidence of diamond particle loss. Moreover, scratch-like wear patterns were observed on the active surface, suggesting localized abrasive degradation (Fig. 11,12).

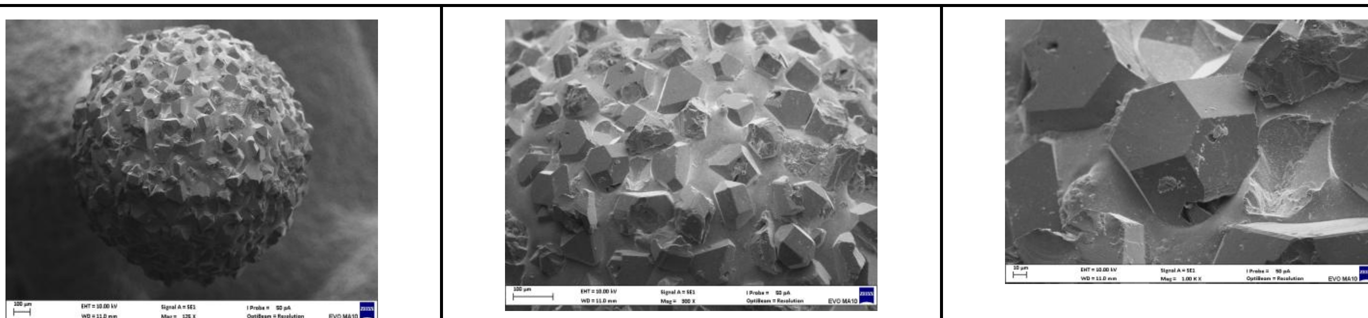

Figure 11: American burs new.

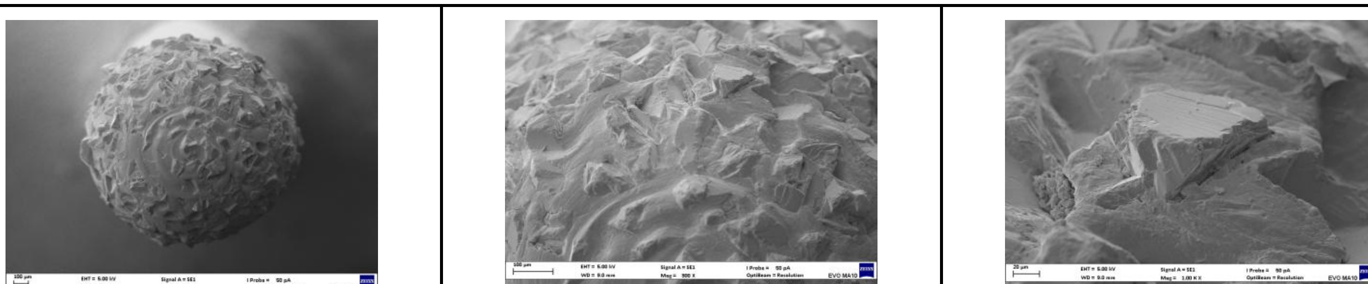

Figure 12: American burs used.

In contrast, the Kerr burs exhibited pronounced wear, with most diamond particles losing their edges and morphological definition. This led to extensive rounding and significant loss of abrasive material. Given that the new Kerr burs already demonstrated a lower density of diamond particles, the remaining grit was exposed to increased cutting stress, which contributed to the accelerated wear. These characteristics are clearly illustrated in Fig. 13,14.

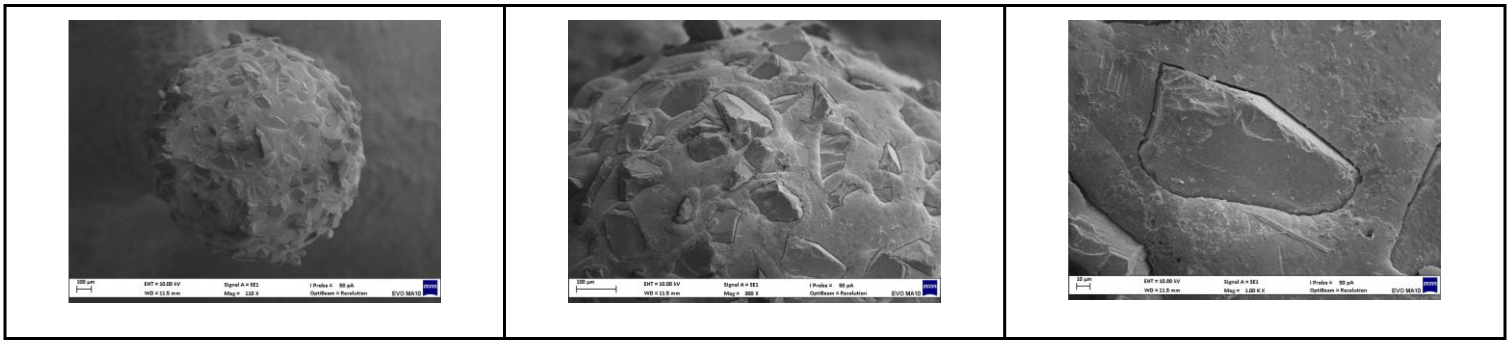

Figure 13: Kerr new.

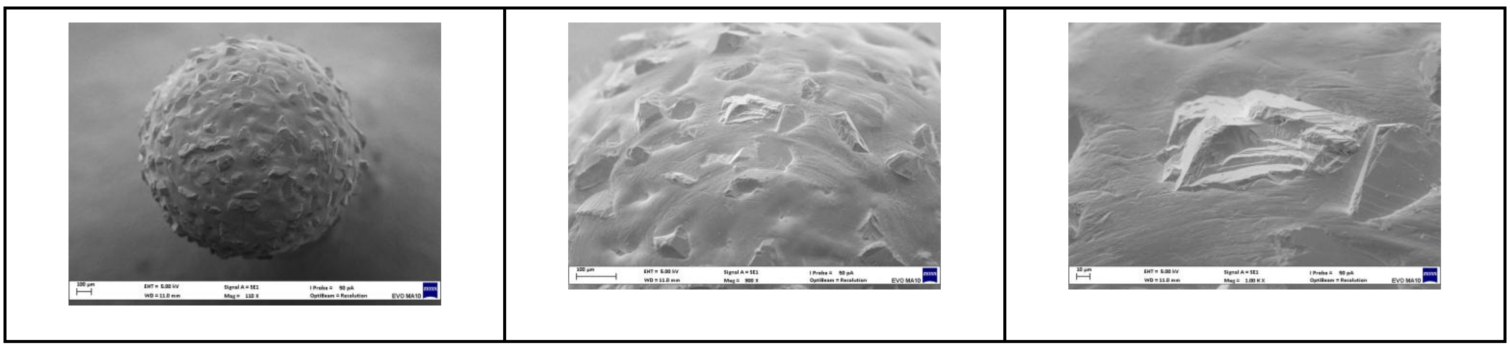

Figure 14: Kerr used.

Lastly, the single-use burs showed the most drastic degradation. All five burs exhibited total diamond particle loss, leaving only the metallic core exposed (Fig. 15,16).

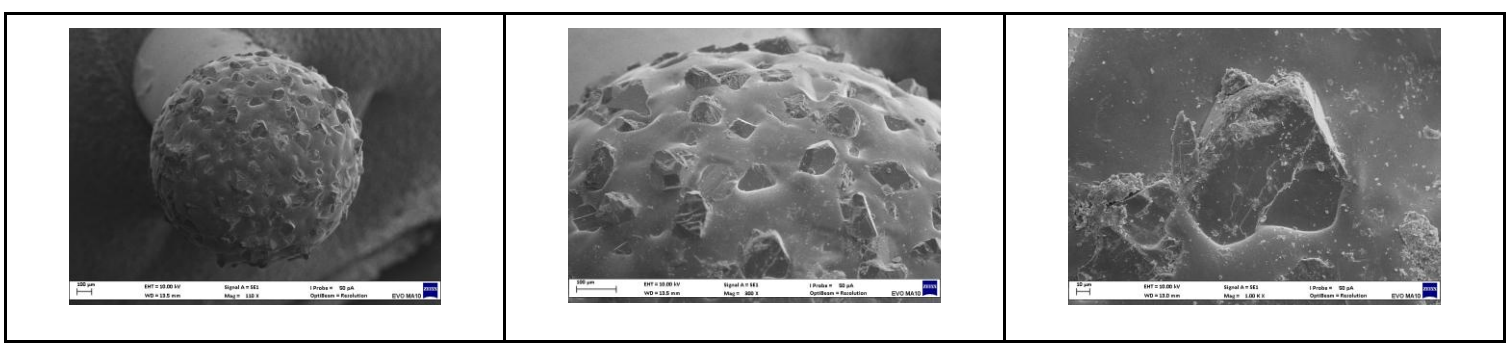

Figure 15: Chinese single-use new.

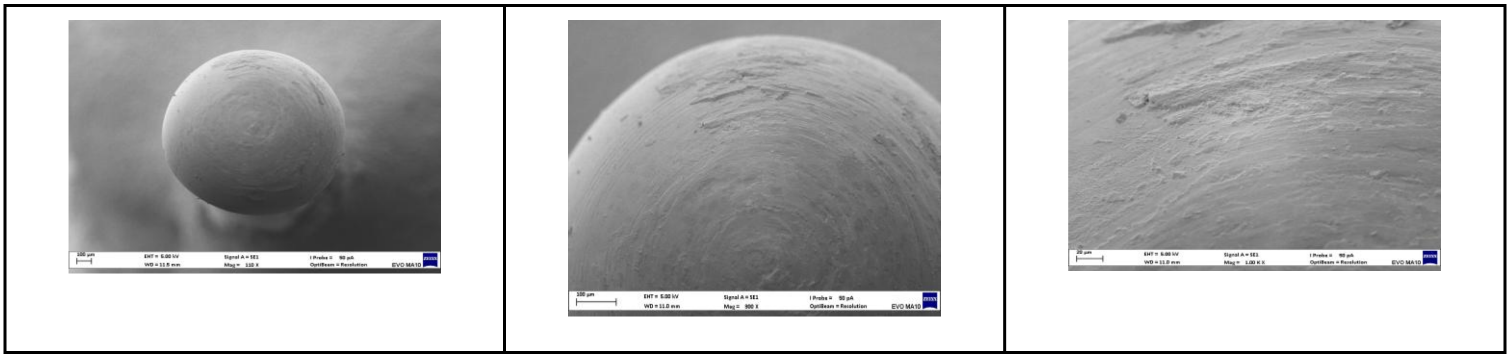

Figure 16: Chinese single-use used.

Discussion

The pursuit of high-quality materials is a constant concern for both dental companies and clinicians, aiming to ensure patient safety and excellence in clinical outcomes. Nowadays, patients demand more aesthetic and conservative treatments, which require precise instruments with high cutting efficiency and optimal performance [20]. In order to achieve minimally invasive cavity preparations, diamond burs must exhibit high cutting efficiency and the ability to withstand multiple cleaning and sterilization cycles without compromising the integrity of the diamond particles. This is essential for preserving tooth structure by minimizing heat generation, thereby reducing potential damage to dentin and pulp tissues [19-21].

The analyzed diamond bur brands exhibited notable differences in grit size, morphology, and distribution. Specifically, burs from KG Sorensen and American Burs displayed diamond particles with sharp, well-defined edges-often exhibiting hexagonal geometry-and a higher density of diamond grit on the active surface. In contrast, burs from Kerr and the single-use brand showed particles with more rounded, poorly defined edges, lower grit exposure, and a greater presence of binder matrix. These characteristics suggest that such burs may require increased applied pressure during use to compensate for their reduced cutting efficiency. Smaller and less prominent diamond particles can diminish cutting performance, elevate friction, and consequently generate more heat. These findings were clearly confirmed by the SEM images. These observations align with findings from previous studies. For instance, Rosentritt, et al., reported that the cutting efficiency of diamond grinders varies significantly depending on the material being cut, with notable differences observed between composite and zirconia substrates [19]. The study highlighted that the design and grit size of the diamond instruments play crucial roles in their cutting performance. Additionally, Kim, et al., found that bur eccentricity influences cutting efficiency, with lower eccentricity correlating with higher cutting performance [22].

Moreover, excessive binder deposition observed in some reusable bur brands partially covered the diamond grits, reducing the number of exposed cutting facets and directly compromising cutting efficiency. Diamond particle rounding was noted across all brands, with the phenomenon being particularly pronounced in the Kerr burs. As for the single-use burs, SEM analysis after five repeated use and sterilization cycles revealed a complete loss of diamond particles, resulting in a total loss of cutting capacity. However, this finding must be interpreted with caution, as these burs are explicitly designed for one-time use. Subjecting them to multiple cycles contrary to their intended application inevitably leads to performance failure and cannot be considered a valid measure of their clinical utility. This observation highlights the importance of adhering to manufacturer guidelines for single-use devices. The gradual decline in cutting efficiency observed across all bur types remains primarily attributable to expected wear over successive uses [17].

Another relevant point of discussion is the tactile perception of cutting speed during use. Although not formally timed, the operator consistently reported that KG Sorensen burs provided faster and more efficient cutting, with less required pressure. Conversely, the Kerr, American Burs, and single-use brands required longer operative time and greater applied force to achieve the same preparation, highlighting their lower cutting efficiency from a clinical standpoint. This qualitative feedback aligns with previous survey based findings, which revealed that operators generally favored diamond burs for their cutting performance, regardless of grit size. Most operators reported using burs repeatedly until they were visibly worn, often with minimal coolant during tooth preparation [23]. These findings underscore the importance of both material quality and operator technique in maintaining optimal clinical performance.

While the primary focus of this study was on the wear and diamond particle loss of various commercial diamond burs, it is important to consider the potential influence of the cleaning and sterilization processes employed. Each bur underwent ultrasonic cleaning using enzymatic detergents, followed by autoclave sterilization at 121°C and 1.2 bar pressure. Previous research has indicated that ultrasonic cleaning, especially when combined with enzymatic solutions, can effectively remove organic debris but may also contribute to surface alterations or degradation of dental instruments over time. For instance, Villaseñor, et al., observed that ultrasonic cleaning could lead to significant deterioration in the cutting surfaces of dental burs [24]. Additionally, repeated autoclave sterilization cycles have been shown to affect the cutting efficiency and structural integrity of dental burs. Spranley, et al., reported that multiple steam autoclaving cycles could impact the sharpness and effectiveness of carbide burs during cavity preparation [25]. Therefore, while all burs in this study were subjected to identical cleaning and sterilization protocols, the observed differences in wear and diamond loss among the brands may, in part, be influenced by their varying resistance to these processes.

This study was conducted under controlled *in-vitro* conditions using bovine teeth, which may not fully replicate the variability and complexity of clinical scenarios in human patients. The number of burs analyzed per brand (n = 5) limits the generalizability of the results and the operator dependent variables, though standardized, cannot be eliminated. In addition, while SEM imaging provided detailed surface characterization, quantitative measurements of cutting efficiency or heat generation during clinical use were not assessed. Future research should include larger sample sizes, clinical evaluations with human teeth and objective performance metrics such as cutting rate, temperature variation, and longevity *in-vivo*. Evaluating newer generations of burs and coating technologies may also offer valuable insights into optimizing bur performance and patient outcomes.

Conclusion

Based on the applied methodology and the obtained results, it can be concluded that all the analyzed diamond burs except for the single-use brand are suitable for at least five cycles of use, cleaning and sterilization without compromising their structural integrity and cutting efficiency.

Conflict of Interest Statement

The authors declare no conflicts of interest.

Funding

This research received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The data sets generated and/or analyzed during the current study are available from the corresponding author on request.

Author Contributions

Conceptualization, C.A.K.J. and R.B.; methodology, T.P. and G.T.S.; software, C.A.K.J.; validation, C.A.K.J., R.B., F.A., A.O., C.S., M.Q., L.H. and C.E.C.-S.; formal analysis, R.B., F.A., C.E.C.-S. and L.H.M.P.; investigation, T.P., R.B., F.A., M.Q., L.H., A.O. and L.H.M.P.; resources, N.N.; data curation, C.A.K.J.; writing-original draft preparation, C.A.K.J. and R.B.; writing-review and editing, R.B. and C.E.C.-S.; visualization, G.T.S.; supervision, R.B.; project administration, R.B.; funding acquisition, R.B.

Ethical Statement

Not applicable.

References

1. De Tomasi A. Storia ed evoluzione delle frase diamantate in odontolatria. Odontostomatol Implanto Protesi. 1976;2:72-4.
2. Walsh JP, Symmons HF. A comparison of the heat production and mechanical efficiency of diamond instruments, stones and burs at 3,000 and 60,000 rpm. N Z Dent J. 1949;45:28-32.
3. Huntley RC. Adaptation of modern instruments with efficient operating speeds in restorative dentistry. North-West Dent. 1956;25:63-8.
4. Koblintz FF, Tateosian FD, Roemer FD, Steen SD, Glenn JF. An overview of cutting and wear related phenomena. In: The Cutting Edge: Interfacial Dynamics of Cutting and Grinding. Bethesda (MD): U.S. Department of Health, Education and Welfare; 1976. p. 151-68.
5. Siegel SC, von Fraunhofer JA. Dental cutting: The historical development of diamond burs. J Am Dent Assoc. 1998;129:740-5.
6. Borges CFM, Magne P, Pfender E, Heberlein J. Dental diamond burs made with a new technology. J Prosthet Dent. 1999;82:73-9.
7. Siegel SC, von Fraunhofer JA. Assessing the cutting efficiency of dental diamond burs. J Am Dent Assoc. 1996;127:763-72.
8. Harkness N, Davies EH. The cleaning of dental diamond burs. Br Dent J. 1983;154:42-5.
9. Leite FB. Central de Material Esterilizado: Projeto de reestruturação e ampliação do Hospital Regional de Francisco. Artigo CME - Central de Material Esterilizado.
10. Sajjanshetty S. Decontamination methods used for dental burs-A comparative study. J Clin Diagn Res. 2014;8:39-41.
11. Gonzaga CC, Falcão Spina DR, de Paiva Bertoli FM, Feres RL, Fernandes AB, da Cunha LF. Cutting efficiency of different diamond burs after repeated cuts and sterilization cycles in autoclave. Indian J Dent Res. 2019;30:915-9.
12. Siegel SC, von Fraunhofer JA. Cutting efficiency of three diamond bur grit sizes. J Am Dent Assoc. 2000;131:1706-10.
13. von Fraunhofer JA, Siegel SC, Feldman S. Handpiece coolant flow rates and dental cutting. Oper Dent. 2000;25:544-8.
14. Ercoli C, Rotella M, Funkenbusch PD, Russell S, Feng C. In vitro comparison of the cutting efficiency and temperature production of 10 different rotary cutting instruments. Part I: Turbine. J Prosthet Dent. 2009;101:248-61.
15. Chung EM, Sung EC, Wu B, Caputo AA. Comparing cutting efficiencies of diamond burs using a high-speed electric handpiece. Gen Dent. 2006;54:254-7.
16. Bae JH, Yi J, Kim S, Shim JS, Lee KW. Changes in the cutting efficiency of different types of dental diamond rotary instruments with repeated cuts and disinfection. J Prosthet Dent. 2014;111:64-70.
17. Pilcher ES, Tietge JD, Draughn RA. Comparison of cutting rates among single-patient-use and multiple-patient-use diamond burs. J Prosthodont. 2000;9:66-70.
18. Jackson MJ, Sein H, Ahmed W. Diamond coated dental bur machining of natural and synthetic dental materials. J Mater Sci Mater Med. 2004;15:1323-31.
19. Rosentritt M, Strasser T, Mueller M-M, Schmidt MB. Cutting efficiency of diamond grinders on composite and zirconia. Materials (Basel). 2024;17:2596.
20. Erlinger A, Al-Haj Husain N, Souza LFB, Eyüboğlu TF, Özcan M. Cutting efficiency of diamond burs with different coatings on ceramic and resin composite materials after multiple use. Eur J Prosthodont Restor Dent. 2025;33:180-8.
21. Dobrzańska J, Dobrzański LB, Dobrzański LA, Dobrzańska-Danikiewicz AD, Gołombek K. What are the chances of Resilon to dominate the market filling materials for endodontics? Metals. 2021;11:1744.
22. Kim D-Y, Son K, Lee K-B. Evaluation of high-speed handpiece cutting efficiency according to bur eccentricity: An *in-vitro* study. Appl Sci. 2019;9:3395.
23. Sharma S, Shankar R, Srinivas K. An epidemiological study on the selection, usage and disposal of dental burs among the dental practitioners. J Clin Diagn Res. 2014;8:250-4.
24. Villaseñor A, Hill SD, Seale NS. Comparison of two ultrasonic cleaning units for deterioration of cutting edges and debris removal on dental burs. Pediatr Dent. 1992;14:326-30.
25. Spranley TJ, Cheramie TJ, Ireland EJ. Cutting effectiveness of carbide burs following multiple steam autoclaving cycles. Gen Dent. 2011;59:53-8.