Performance Advantages of the Hip DiamondCut™ Burr

Arthrex Research

INTRODUCTION

During arthroscopic hip procedures, diamond burrs are commonly chosen as precision finishing devices to contour and refine the femoral neck. These devices require a high degree of control to achieve adequate bone removal and surface smoothness, both of which are critical for accurate anatomical reshaping. The purpose of this study[1] was to compare the cutting performance of the Hip DiamondCut burr (Arthrex, Inc.) and the CrossBlade XL Diamond Bur (Stryker) by quantifying two primary metrics: surface roughness and volumetric bone removal.

METHODS AND MATERIALS

The following devices were used for this experiment: Hip DiamondCut burrs (sizes 4 mm and 5 mm, n = 20 per size) and CrossBlade XL Diamond Burs (sizes 4 mm and 5.5 mm, n = 20 each). Burrs were placed within the respective shaver handpieces and mounted to a 4-axis SCARA industrial robot (Epson G10, Epson Robots; Carson, CA) using a custom, 3D-printed fixture. Below the robot, an epoxy resin block was secured in a 3D-printed fixture attached to an acrylic basin, which was then filled with water to simulate a physiologically relevant test environment. Epoxy was used as a bone surrogate to control specimen variability and provide a stable, uniform cutting surface. Suction tubing connected the shaver handpiece to an external pump to maintain continuous water flow, replicating arthroscopic irrigation and aspiration.

The robot advanced the handpiece until a 2-N normal load was detected on the epoxy block. Then, the handpiece was advanced to perform a 14-mm linear drag across the epoxy surface, cutting at 2 mm/s with the burr in forward mode. Cutting speeds were set based on system capabilities: the Arthrex system ran at its maximum of 8000 revolutions per minute (rpm) while the Stryker system was set to 8100 rpm, which was the closest available increment to match conditions across both groups. After each cut, the robot retracted the handpiece. Four trials of this procedure were performed on each burr size, with 5 burrs used per trial (ie, 20 cuts per burr size). Surface roughness and volumetric removal were measured with a Keyence VK-X3050 laser microscope, reporting the average surface roughness (Sa; µin), the maximum height (Sz; µin), and the average 3D volume removed (thou^3).

Statistical analysis was conducted using a Welch two-sample *t* test on both the average surface roughness values and the average volumetric removal values.

RESULTS

Surface roughness metrics were quantified across 80 total cuts (20 per burr size category). For each size, 5 burrs were tested, and 4 cuts per burr were analyzed. The 4 mm Hip DiamondCut burrs exhibited lower Sa values compared with the 4 mm CrossBlade XL Diamond Burs (Arthrex 4 mm: 672 µin vs Stryker 4 mm: 1235 µin; Table 1). Sz values were also lower for Arthrex than Stryker in the 4 mm size (Arthrex 4 mm: 7983 µin vs Stryker 4 mm: 9969 µin; Table 1). Across all 20 cuts, the 4 mm CrossBlade XL Diamond Bur generated significantly rougher and more variable cut-path surfaces compared with the 4 mm Hip DiamondCut burr. Similarly, the 5 mm Hip DiamondCut burr exhibited lower Sa values compared with the 5.5 mm CrossBlade XL Diamond Bur (Arthrex 5 mm: 576 µin vs Stryker 5.5 mm: 962 µin; Table 1). Sz values were also lower for Arthrex than Stryker (Arthrex 5 mm: 5765 µin vs Stryker 5.5 mm: 6845 µin; Table 1). Across all 20 cuts, the 5.5 mm CrossBlade XL Diamond Bur generated significantly rougher and more variable cut-path surfaces compared with the 5 mm Hip DiamondCut burr.

Table 1. Surface Roughness Results

Company	Burr Size (mm)	Average Surface Roughness (µin)	Maximum Height (µin)
Arthrex	4	672	7983
Stryker	4	1235	9969
Arthrex	5	576	5765
Stryker	5.5	962	6845

Volumetric removal was evaluated for each size; 5 burrs were tested, and 4 cuts per burr were analyzed (20 per burr size category). The 4 mm Hip DiamondCut™ burrs removed substantially greater material volume compared with the 4 mm CrossBlade XL Diamond Burs (427,370 thou^3 vs 276,669 thou^3; Table 2). A similar trend was observed in the larger burr size. The 5 mm Hip DiamondCut burrs removed greater material volume than the 5.5 mm CrossBlade XL Diamond Burs (459,161 thou^3 vs 213,958 thou^3; Table 2).

Table 2. Volumetric Removal Results

Company	Burr Size (mm)	Average Volumetric Removal (0.001 in)^3
Arthrex	4	427,370
Stryker	4	276,669
Arthrex	5	459,161
Stryker	5.5	213,958

The representative 3D volume map images of the 4 mm Hip DiamondCut burr and the 4 mm CrossBlade XL Diamond Bur can be found in Figures 1 and 2.

Figure 1. 3D volume map of the 4 mm Hip DiamondCut burr sample 1.

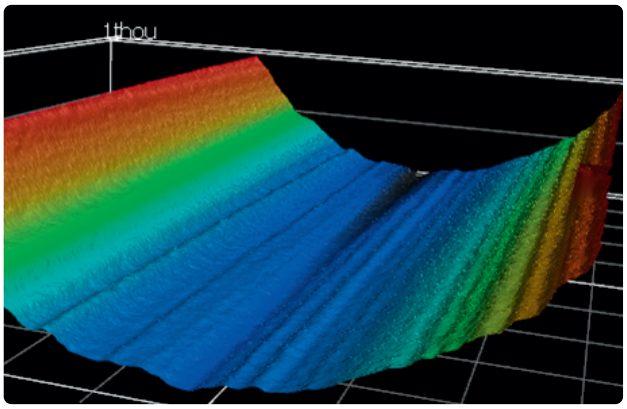
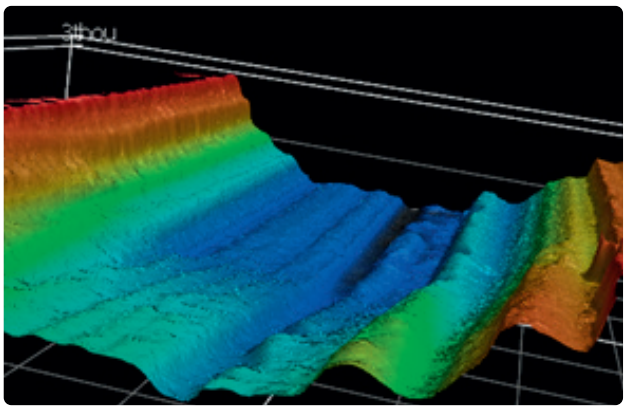


Figure 2. 3D volume map of the 4 mm CrossBlade XL Diamond Bur sample 1.



CONCLUSION

The Welch two-sample *t* test demonstrated that the Arthrex 4 mm and 5 mm Hip DiamondCut burrs produced a significantly smoother, more uniform cut (Sa) than the Stryker CrossBlade XL Diamond Burs (4 mm: $t = -7.28$, $df = 23$; 5 mm: $t = -7.35$, $df = 32$; $P < .0001$). The Arthrex 4 mm burr generated surfaces approximately 46% smoother than Stryker's 4 mm burr, while the Arthrex 5 mm burr produced cuts about 40% smoother than Stryker's 5.5 mm burr. Across both size configurations, Arthrex consistently exhibited lower roughness magnitude and variability, indicating a more uniform cut topography compared with the rougher, less consistent surfaces produced by Stryker.

The Arthrex 4 mm Hip DiamondCut burr achieved 55% higher mean volumetric removal than the 4 mm CrossBlade XL Diamond Bur, with the Welch two-sample *t* test confirming a statistically significant difference ($P = .0001$). Similarly, the 5 mm Hip DiamondCut burr demonstrated 115% higher average volumetric removal compared with the 5.5 mm CrossBlade XL Diamond Bur, also reaching statistical significance ($P = .0001$). These findings demonstrate substantially greater cutting efficiency for the Hip DiamondCut burrs across both tested sizes.

Reference

1. Arthrex, Inc. Data on file (PLM1178877). Naples, FL; 2026.