Efficacy of AutoLock™ Technology in Minimizing Iatrogenic Cartilage Damage

Arthrex Research

INTRODUCTION

Accidental abrasion of articular cartilage can occur during the insertion and removal of an arthroscopic shaver into and from the joint space. The Synergy Shaver™ system incorporates a novel feature, known as AutoLock Technology, which automatically closes the cutting window upon attachment of the shaver blade into the handpiece and cessation of motor activity. Unlike manual window locking features currently on the market, this technology enhances convenience and eliminates the need for user intervention.

This study aims to evaluate the efficacy of AutoLock Technology in minimizing iatrogenic cartilage damage by assessing the frequency and depth of cartilage abrasion under three cutting window conditions (closed, open, and half open).

MATERIALS AND METHODS

Five porcine knees obtained 48 hours after harvest were prepared, exposing the femoral condyles. Four zones were drawn on the condyles to demarcate the shaver contact region for each cutting window condition (control, closed, open, half-open).

Each specimen was treated using a new 4.5 mm serrated shaver blade, which was connected to the shaver handpiece and control box. The blade was set to the desired window condition and scraped once against the condyle in the respective zone, simulating accidental abrasion when entering or exiting the joint. The control group was not exposed to the shaver.

Cartilage samples were harvested perpendicular to the path of the blade using a scalpel and chisel, then immediately placed into phosphate-buffered saline. Once all 20 cross sections were collected, sections were further trimmed using a scalpel to yield cleaner images, transferred to complete media, and stored in a humidified incubator overnight at 37 °C.

A Live/Dead stain was performed on the samples, which were then photographed using a fluorescent microscope at 4× magnification. Full-focused microscope images were evaluated for visible damage to the cartilage. If damage was present, a scale bar was added to the photograph, and the maximum depth of damage was measured using ImageJ software.

RESULTS

The cross sections exposed to the shaver in the open or half-open positions were 4× more likely to have observed damage to the cartilage surface when viewed with a microscope compared to the closed position (80% vs 20%) (Table 1).

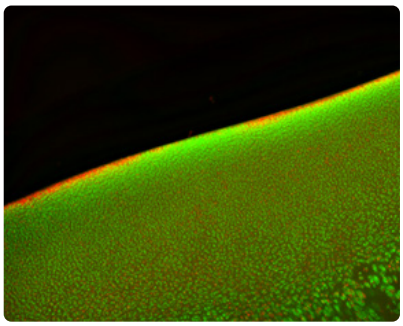
In cases with observed cartilage damage, the half-open group created the deepest defects in the cartilage surface (0.36 mm ± 0.09 mm), followed by the open group (0.28 mm ± 0.12 mm), while the single defect caused by the closed shaver had a depth of 0.19 mm. (Table 1).

Table 1. Frequency and depth of cartilage damage per window condition.

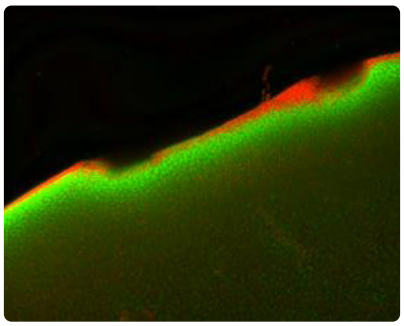
	Control	Closed	Open	Half Open
Samples with cartilage damage observed on microscope	0%	20%	80%	80%
Average depth of cartilage damage when damage was observed (mm)	0.00 ± 0.00	0.19 ± 0.00	0.28 ± 0.12	0.36 ± 0.09

The representative fluorescence microscopy images can be found in Figure 1.

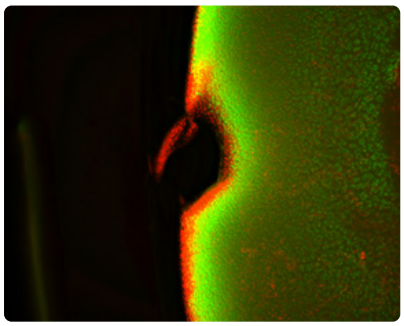
Figure 1. Representative cartilage images for each AutoLock™ Technology cutting window condition obtained using fluorescence microscopy.



Closed



Open



Half open

CONCLUSION

Frequency of cartilage abrasion: Cross sections exposed to the shaver in the open or half-open positions were 4× more likely to damage porcine cartilage compared to the closed cutting window, based on the percentage of samples with cartilage damage observed using fluorescence microscopy.

Depth of cartilage abrasion: The half-open group created the deepest defects into the cartilage surface (0.36 mm ± 0.09 mm), followed by the open group (0.28 mm ± 0.12 mm), while the single defect caused by the closed shaver had a depth of 0.19 mm.

This study highlights the importance of the AutoLock Technology and its ability to automatically close the cutting window, since the closed cutting window contributed to the lowest rate of observed damage to the porcine cartilage as well as the shallowest defects when damage was observed.

Reference

1. Arthrex, Inc. Data on file (APT-1067356). Naples, FL; 2025.