

# The Collagen Coating Difference: Early Tenocyte Adhesion and Viability on *Internal/Brace*™ Collagen-Coated FiberTape® Are Superior Compared to Competitive Suture Tapes

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## Background

One goal of ligament reconstruction is to provide joint stability. The *Internal/Brace* ligament augmentation repair uses collagen-coated FiberTape sutures to provide immediate short-term stability. The suture tape acts as a seat belt, shielding the ligament from excessive stress and preventing reinjury.<sup>1,2</sup> Long-term stability following an injury is a function of the successful biologic healing of the ligament.<sup>3</sup> A suture that supports the formation of new tissue and collagen along its surface may contribute to long-term healing and joint stability.

The purpose of this study was to evaluate and compare tenocyte viability and adhesion to collagen-coated FiberTape suture and four competitor suture tapes: Parcus Braid™ (Parcus Medical), Ultratape (Smith & Nephew), XBraid TT (Stryker), and Hi-Fi® Tape (Conmed).

## Materials and Methods

Human tenocytes (Angio-Proteomie) were cultured in complete DMEM/F-12 (Gibco). Cultures were maintained at 37°C in a humidified atmosphere at 7.5% CO<sub>2</sub> and cells were used at P4 for experiments.

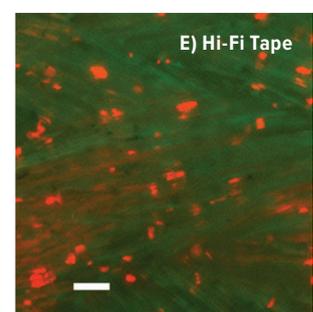
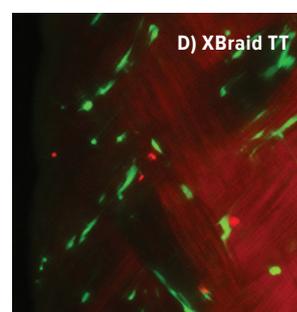
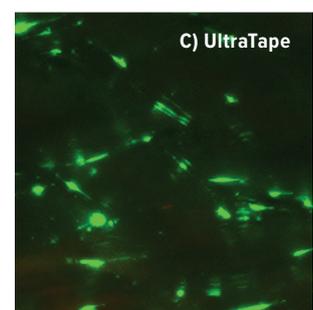
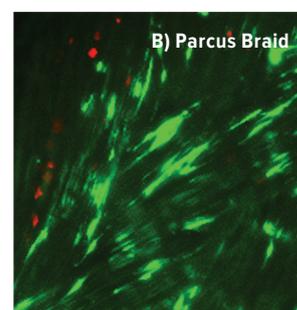
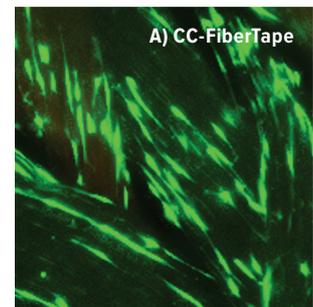
Suture was cut into sections 1 cm in length (n=10). The sections were individually placed into the wells of a 24-well plate and held in place with a sterile PTFE O-ring (McMaster). Tenocytes (20,000 in 100 µL) were added directly on top of the suture. The sutures were incubated at 37°C for 45 minutes to allow initial adhesion and additional media was added prior to overnight incubation. Twenty-four hours after the initial cell seeding, the suture samples were gently rinsed with PBS and transferred to a fresh well so that only adhered cells were assayed.

The samples were stained with a LIVE/DEAD™ kit (Invitrogen). Two images of each suture at 4X magnification using a fluorescence microscope (Keyence BZ-X710, Figure 1). ImageJ (NIH) was used to count the number of live and dead cells on the surface of the suture.

Cell adhesion was indirectly measured with an alamarBlue® (Bio-Rad) assay to quantify relative metabolic activity among the samples.

The cell viability and cell adhesion among different suture types were compared with a one-way ANOVA if the data were normally distributed, or with a Kruskal-Wallis ANOVA on ranks and post-hoc Tukey test ( $\alpha=0.05$ , SigmaPlot 14.0).

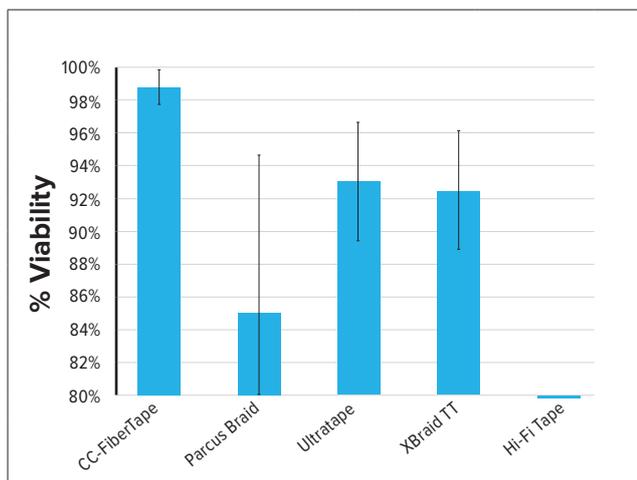
**Figure 1.** LIVE/DEAD-stained tenocytes adhered to (A) collagen-coated FiberTape suture, (B) Parcus Braid, (C) Ultratape, (D) XBraid TT, (E) Hi-Fi tape. Living cells appear green while dead cells appear red.



## Results

There were differences observed in the viability of tenocytes adhered to the different suture groups ( $P < .001$ , Figure 2). The viability of adhered tenocytes on collagen-coated FiberTape suture was significantly higher relative to Parcus Braid and Hi-Fi tape in addition to trending higher than Ultratape and XBraid TT.

**Figure 2.** Viability of adhered human tenocytes<sup>4</sup>



The metabolic activity (% alamarBlue reduction per hour) of adhered tenocytes was significantly higher on collagen-coated FiberTape suture than on Ultratape, XBraid TT, or Hi-Fi tape (Figure 3,  $P < .001$ ).

## Discussion and Conclusions

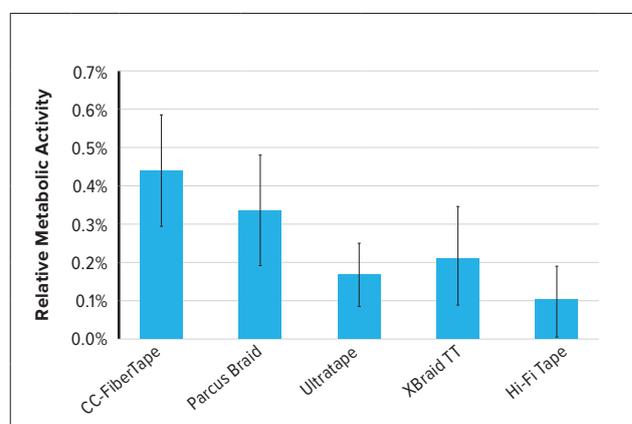
Parcus Braid, Ultratape, and XBraid TT sutures are made of UHMWPE, while collagen-coated FiberTape suture is made of a blend of UHMWPE and polyester with a coating of type 1 bovine collagen. The composition of the Hi-Fi tape is unknown; however, in contrast to other sutures, the Hi-Fi tape was observed to have a low wettability when placed in culture media. This property of the Hi-Fi tape may be responsible for the low tenocyte adhesion and viability observed.<sup>5,6</sup>

The superior tenocyte adherence and viability to the collagen-coated FiberTape suture indicates several biological advantages. In cases where minimal native tissue is present, the collagen-coated FiberTape suture may encourage tissue repair for long-term reconstruction and reduce the risk of an inflammatory reaction associated with foreign body response.<sup>7</sup> This may eliminate the need for an autograft or allograft in these patients.

In the event an allograft or autograft is required, the newly formed matrix may improve incorporation of the graft into the reconstructed ligament as well as provide stability to prevent elongation of the graft.<sup>8</sup>

Collagen-coated FiberTape suture demonstrated superior tenocyte adhesion in comparison to Parcus Braid, Ultratape, XBraid TT, and Hi-Fi tape. Although these other devices may claim similar mechanical properties with regards to initial stability, the early biologic advantages of the collagen-coated FiberTape suture observed in this study could lead to improved long-term outcomes.

**Figure 3.** Indirect human tenocyte adhesion via metabolic activity measurement. Metabolic activity is indicative of the number of tenocytes that remain adhered to the suture following the initial cell seeding.<sup>4</sup>



## References

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