

Background: The objective of the present study was to determine the feasibility and biocompatibility of a silk scaffold and of a composite silk scaffold in terms of new tendon generation using a rabbit Achilles tendon model.

Methods: The silk scaffold was constructed using a weaving machine and dry-coated with collagen-hyaluronan (HA), whereas the composite silk scaffold was made by covering a silk scaffold with a lyophilized collagen-HA substrate. We implanted the tendon prostheses into Achilles tendon defects in 16 white New Zealand rabbits. We established the following three experimental groups based on the replacement substitutes used: group I (silk scaffold alone); group II (composite silk scaffold); and group III (composite silk scaffold ensheathed in a human amniotic membrane). Implants were harvested 2, 8, and 12 weeks post-implantation. Histological examinations were conducted using hematoxylin-eosin, Masson's trichrome, and by performing immunohistochemical staining for CD34. Tenocytes were cultured *in vitro* to compare cell populations in the three groups.

Results: After 8 weeks, all experimental specimens resembled normal Achilles tendons; the three groups were indistinguishable based on gross examination. The histologic examination revealed more organized collagen fibrils in groups II and III, which showed a dense, parallel, linear organization of collagen bundles. CD34 staining revealed neoangiogenesis in groups II and III. The cellular densities on composite silk scaffolds were 40% higher on average than on silk scaffolds in 30-day tenocyte cultures.

Conclusions: The composite silk scaffold is a much more biocompatible tendon prosthesis than the silk scaffold. Collagen-HA substrates accelerate cellular migration and angiogenesis in neotendons.

References

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Disclosure

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