**INTRODUCTION:** Recently, there is a renewed interest in improving the healing of the anterior cruciate ligament (ACL) with functional tissue engineering techniques that stimulate the healing of connective tissues. The expected advantages of a healed ACL include the preservation of the insertion sites while avoiding side effects of using grafts. A bioscaffold, namely small intestinal submucosa (SIS) has shown to be promising for ligament healing. The objective of this study was to evaluate the effects of using SIS in combination with suture repair on the healing of the goat ACL. We hypothesized that the SIS can enhance healing tissue formation, while the SIS sheet wrapped around the injury site can contain the healing response, and guide tissue growth, which will eventually improve the biomechanical properties of the healing ACL and its contribution to knee stability.

**METHODS:** Ten goats were equally divided into two groups (1: suture repair only; 2: suture repair and SIS treatment). In Group 1, the left ACL was transected at its midsubstance and suture repaired with absorbable sutures (Vicryl 2-0) using a customized locking Becker-suture-technique (figure 1). Four sutures were placed in the distal part of the ACL stump: anteromedial, anterolateral, posteromedial and posterolateral. The same was done for the proximal part of the ACL stump. Subsequently the ACL stumps were approximated by knotting each suture to its opposite counterpart. In Group 2, the left ACL was transected and suture repaired like in Group 1, with the addition of SIS around and inside the ACL. In both groups, the right ACL was left intact and served as intact control. All animals were euthanized after 12 weeks of healing. To test the knee stability, the anterior-posterior tibial translation of the knee joint and in-situ forces of the ACL were measured using a robotic/universal testing-system (KR-125, KukaRobots). Subsequently, the morphology of the ACL was recorded by observation and the cross-sectional-area of the ACL was measured by a area force-moment sensor testing-system (KR-125, KukaRobots). In the healing ACL, it was observed that the anterior part of the normal insertion site is missing (arrows). This part should be the location of the insertion site of the anteromedial fiber bundles.

**RESULTS:** In Group 2, one suture repair failed at the end of the operation and was excluded from follow-up. Gross morphology of the remaining 9 goats after 12 weeks showed that there was tissue formation in all knees. However, the healed ACL’s in group 2 were more opaque. The cross-sectional-area was not significantly different between the dimensions of the tibial insertion of the healing ACLs in the two experimental groups were different from of the normal ACL’s. The brackets in figure 1 and 2 indicate the area of the normal ACL insertion site which spans over the eminentia intercondylaris. In the healing ACL it was observed that the anterior part of the normal insertion site is missing (arrows). This part should be the location of the insertion site of the anteromedial fiber bundles.

**DISCUSSION:** In this study it was shown that a new suture repair technique with absorbable sutures combined with SIS can initiate and enhance the healing of the goat ACL. The stiffness values and AP translations were comparable to those found in previous studies. Additionally, these results are comparable to an ACL reconstruction with a tendon graft in goats. The finding that the insertion site of the ACL was not fully covered indicates that (a part of) the anteromedial (AM) bundle is missing which in turn explains the smaller cross-sectional area, lower stiffness and higher values for the AP translation in the healing ACLs in both groups. Nevertheless, these positive findings warrants further research with this promising approach and will focus on healing of all the fiber bundles, including the AM fiber bundles.

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**REFERENCES:**
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