

ORIGINAL ARTICLE**A Comparison of Functional Outcomes after Biostable and Bioabsorbable Interference Screw Fixations in Arthroscopic ACL Reconstruction****Muhammad Sakti¹, Ery Wildan¹, Nur Rahmansyah¹, Erich Subagio¹****Authors' Affiliation:** ¹Department of Orthopaedics and Traumatology, Hasanuddin University Makassar, South Sulawesi, Indonesia**Corresponding author:** Ery Wildan, MD, Email: erywildan10@gmail.com, Mobile: 081245462646**ABSTRACT**

Anterior cruciate ligament (ACL) injury is common, and ACL reconstruction is one of the most frequently performed sports medicine surgical procedures. In an ACL reconstruction, the graft fixation impacts the stability and healing of the construct. The objective of this study was to compare the clinical outcome of biostable and bioabsorbable interference screw fixations in arthroscopic ACL reconstructions.

This was a prospective, randomized study. Arthroscopic ACL Reconstruction replaced a ruptured ACL ligaments with a single bundle hamstring graft and using Endobutton as femoral fixation. For tibial fixation, patients in Group 1 received biostable screws and patients in Group 2 received bioabsorbable screws. Progress in functional outcomes at 1,3,6,9 months and 1 year was assessed by using Mann Whitney U- test. Functional outcomes in the two groups were compared by using Spearman's Correlation test.

In each group, there were statistically significant improvements in functional outcomes after 1,3,6,9 months and 1 year on Mann-Whitney U-test. The comparison of functional outcomes of two group, showed statistically significant differences in Tegner Activity Score but not in Lysholm Knee Score.

In our study, statistically significant difference was found, the increase in Tegner Activity scores in the Bioabsorbable group was higher than Biostable group. However, further authentication is required by doing long term studies.

Keywords: Anterior cruciate ligament reconstruction, biostable interference screw, bioabsorbable interference screw**INTRODUCTION**

Anterior cruciate ligament (ACL) injury is common, and ACL reconstruction is one of the most frequently performed sports medicine surgical procedures.^{1,2} Certain aspects of ACL reconstruction technique, including femoral tunnel position, graft type, and graft fixation, are of interest because they affect clinical outcomes.³

Anatomic placement of ligament substitutes has fostered rehabilitation efforts that stress immediate and full range of motion, immediate weightbearing, neuromuscular strength and coordination, and early return to athletic competition (3 months). This has placed extreme importance on secure graft fixation at the time of ligament reconstruction. Current ligament substitutes require a bony or soft tissue component to be fixed within a bone tunnel or on the periosteum at a distance from the normal ligament attachment site.³

The graft fixation is critical for primary stability of the graft; no proper rehabilitation protocol may be started without adequate fixation. If for femoral fixation there are several fixation systems available, for the tibial site interference fixation type is still the most used.⁴

For many years the metallic interference screw was the "golden standard" in ACL graft fixation. As the inconveniences related to magnetic resonance imaging (MRI) artefacts, possible graft laceration during insertion or removal, as well as the difficulties encountered at screw removal, new materials for screw fabrication were researched, including biodegradable polymers and biostable polymers.⁴

The second class of materials used was based on poly- L-lactic acid (PLLA), a polymer which has good strength and long degradation period (2-5 years). In terms of strength of fixation and pull out strength the results were very good but complications related to their behaviour in human body, both

on short and long terms, were published. Among them, most quoted are tunnel enlargement, osteolysis and cyst formation. Inflammatory reaction and cyst formation are among the documented complications of polymeric interference screws. In a recent study, published in 2014 Ramsingh et. all reported a 5% rate of these complications and recommend that such complications should be considered when performing ACL reconstruction with biodegradable polymeric implants.⁵

From the class of the bioinert polymers most commonly used is polyetheretherketone (PEEK), a rigid, semicrystalline polymer, with a high resistance to chemical and thermal degradation and excellent mechanical properties. PEEK offers the advantages of good stable fixation and postoperative imaging while not having the complications associated with polymer degradation. PEEK implants in animals have shown no acute inflammatory response and only mild chronic inflammation⁶

Many questions remain to be clarified on aspects which are related to optimal graft-fixation techniques and the properties of the materials which are used to fabricate the medical devices which are used in ACL reconstructions. Graft fixations can be achieved during anterior cruciate ligament (ACL) reconstructions with use of either bioabsorbable screws or biostable screw.^{7,8}

The objective of this study was to compare the functional outcomes after bioabsorbable and biostable interference screw fixations in arthroscopic anterior cruciate ligament reconstructions by using hamstring grafts.

METHODS

This study was a Comparative Analytic Study with Prospective Approach. This study was conducted in Orthopedic and Traumatology Department Faculty of Medicine, Hasanuddin University - Hasanuddin University Education Hospital, Makassar between November 2016 to January 2018.

First we identified patients with ACL rupture who are treated with ACL reconstruction by using Bioabsorbable interference screw and Biostable interference screw from medical records and patient registers in the Orthopedic and Traumatology Department Medical Faculty of Hasanuddin University - Education Hospital of Hasanuddin University, Makassar as secondary data..

Patients who meet research criteria undergo interview procedures and fill out questionnaires regarding the knee which would be operated, using Lysholm Knee Score Scale and Tegner Activity Scale as primary data. Assessment is carried out in 5 stages, namely, 1 month, 3 months, 6 months, 9 months and one

year postoperatively. Subjective assessment is carried out by interview process and filling out questionnaires which will result as qualitative assessment. The collected data were analyzed and compared between the use of bioabsorbable interference screw and biostable interference screw using statistical analysis. Data analysis was performed using computer program SPSS for Windows version 22.

RESULTS

Comparison of functional outcome using the Lysholm Knee Score (LS score) at 1 month, 3 months, 6 months, 9 months and one year postoperatively can be seen in fig 1. And based on correlation coefficient showed no statistically significant differences in Lysholm Knee Scores (fig 2)

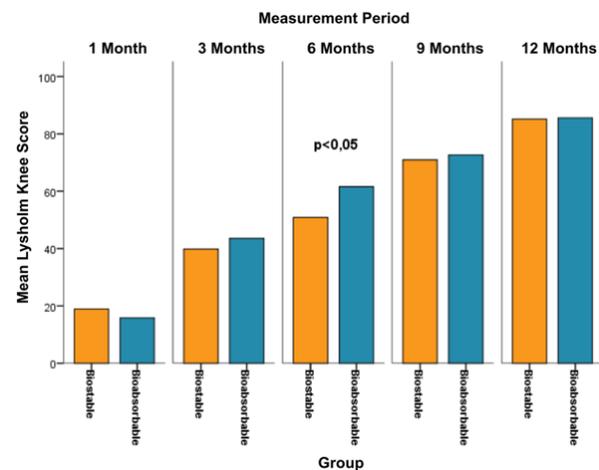


Fig 1: Comparison of Lysholm Knee Score between the Biostable and Bioabsorbable groups using Spearman's Correlation test

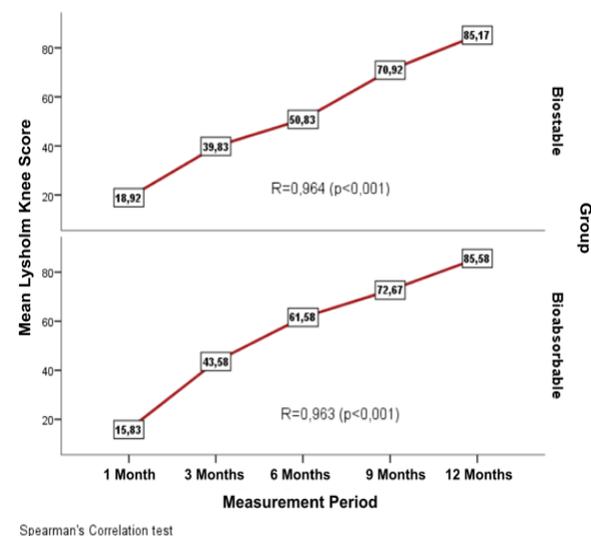


Fig 2: The comparison of functional outcomes of two group using Lysholm Knee Score, based on the value of the correlation coefficient (R)

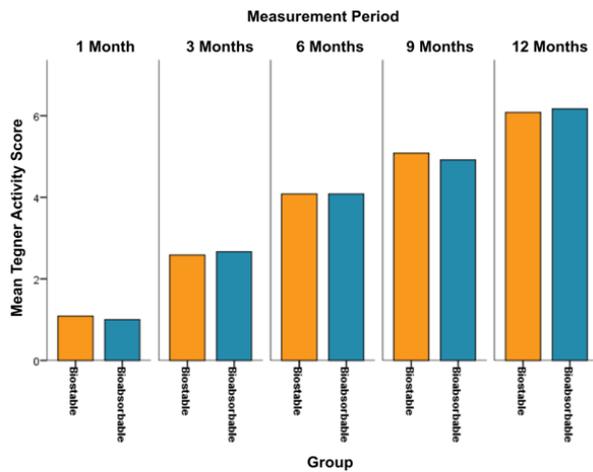


Fig 3: Comparison of Tegner Activity Score between the Biostable and Bioabsorbable groups using Spearman's Correlation test

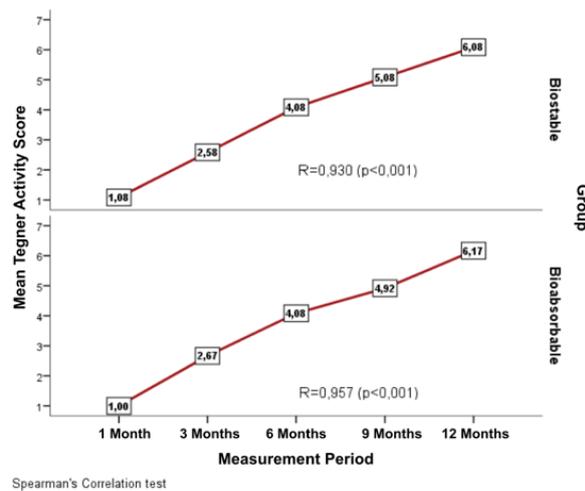


Fig 4: The Comparison of Functional Outcomes of Two group using Tegner Activity Score, Based on The Value of The Correlation Coefficient (R)

Comparison of physical activity after surgery as measured by the Tegner Activity Score at 1 month, 3 months, 6 months, 9 months and 12 months postoperatively can be seen in Fig 3. Based on the value of the correlation coefficient (R), it can be concluded that the increase in TA scores in the Bioabsorbable group was higher than the increase in the Biostable group (fig 4).

DISCUSSION

This study found that the overall average Lysholm Knee Score at postoperative 1st, 3rd, 9th and 1 year between the biostable and bioabsorbable groups was not statistically significant. However, after 6 months of surgery, the mean Lysholm Knee Score in the bioabsorbable group was significantly higher compared to the biostable group. According to Janssen et al⁴⁰,

graft healing in the hamstring graft 6 months after surgery is in the "ligamentization" stage. The stage where the vascularity of the graft decreases to normal values is the same as in the intact ACL and is distributed throughout the graft. At this stage we also find collagen fiber. This study has been shown that the mechanical properties of the graft began to develop at this stage and reach the maximum property at 1 year after reconstruction. From this study it was also found that stable graft fixation was only needed in the initial phase of graft healing (early graft healing phase) which occurred between weeks 2 and 4, so it can be concluded that there was no correlation between the increase in Lysholm Knee score after 6 months after reconstruction with the use of fixation both by bioabsorbable and biostable. However, further studies are needed to compare the processes that occur in graft healing to different graft fixation properties.

In this study, the mean Tegner Activity Score in the measurements of 1 month, 3 months, 6 months, 9 months and 12 months post-reconstruction was not significant between the bioabsorbable and biostable groups. But the value of the correlation coefficient changes in TA scores (Tegner Activity Score) according to the time of measurement was higher in the bioabsorbable group compared to the biostable group. This might be due to differences in physical activity/exercise in the two sample groups where there were 2 amateur soccer athletes in the bioabsorbable group compared to the absence of athletes in the biostable group. From Janssen et al⁴⁰ it was also agreed that ACL graft healing could only develop if there was a "mechanical loading" that might have an effect on athletes compared to non-athletes. Although the magnitude of "mechanical loading" is not clearly connected with various phases of healing grafts. However, it is important that rehabilitation can cause excessive "tensioning" of the graft so that it must be avoided for 3 months after surgery.

CONCLUSION

The difference in mean Lysholm Knee Score and Tegner Activity Score in the Biostable group with Bioabsorbable at 1 month, 3 months, 6 months, 9 months and 1 year after reconstructive surgery was not statistically significant.

Based on the value of the correlation coefficient (R), the increase in LS scores in the Biostable group was not different from the increase in the Bioabsorbable group while the value of the correlation coefficient (R), the increase in TA scores in the Bioabsorbable group was higher than that of Biostable.

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