INTRODUCTION:
The menisci are fibrocartilaginous structures arranged in circumferential bundles that serve to disperse compressive load and resist shear forces. Extensive research has demonstrated the importance of intact menisci for optimal load transmission, shock absorption, proprioception, chondroprotection, lubrication and nourishment of the neighboring articular cartilage. Removal of the meniscus significantly increases contact stress at the tibiofemoral articulation and increases the risk of progression to osteoarthritis. Allograft meniscus transplantation has been hypothesized to be a reasonable treatment option for young (under 50-years-old), meniscus-deficient patients who experience pain in the tibiofemoral compartment. This surgical procedure has well-established short-term efficacy in improving joint function, pain level, performance of activities of daily living, and potentially slowing the development of tibiofemoral arthrosis. However, the long-term efficacy of this procedure has not been well-described in the literature. The purpose of this study is to report the long-term results (minimum 7-years post-operative) of meniscal allograft transplantation.

METHODS:
A retrospective review of all patients having undergone allograft meniscal transplantation by a single surgeon (senior author) between November 1997 and July 2002 was performed. An IRB approved consent (IRB# 09090306) was obtained from all patients in the study and a minimum follow-up of 7 years was necessary for inclusion into this study. Three patients (11%) in this cohort had a failed allograft and went on to have a subsequent intervention and were excluded from further analysis.

Pre-operative subjective data and physical examination findings comparing range of motion, pain, effusion and stability from this cohort were compared to the post-operative findings. When possible a radiographic evaluation of the knee was performed and was assessed for healing of the bone plugs or bridge and the remaining joint space. Patient outcome evaluations were performed using the Short Form SF-12 PCS & MCS (Physical Component Summary & Mental Component Summary), Lysholm, International Knee Documentation Committee (IKDC), and the Knee Injury and Osteoarthritis Outcome Score (KOOS) which is divided into 5 parts: Pain, Symptom, Activities of Daily Living (ADL), Sports, and Quality of Life (QOL). Patients were also asked to rate their overall satisfaction on a ten point scale and to report if they would choose to have the operation again.

Standard t-tests of significance were performed to compare pre-operative scores to post-operative outcomes. The 2-tail Mann-Whitney test of significance was used to compare A/P & M/L length from failed cases. Statistical analysis showed that there was no significance between patient age of successful cases and failed cases (P > .05). The mean A/P length of the 23 successful allograft menisci was 40.87 mm (range, 31-50; SD, 5.4), and the mean M/L of the successful allografts was 33.59 (range, 28-39; SD, 2.8). The mean A/P length of the 3 failed allograft menisci was 41.87 mm (range, 35-49.9; SD, 7.5), and the mean M/L of the failed allografts was 35.83 mm (range, 33-38; SD, 2.6). Statistical analysis showed that there was no significance between the allograft A/P length or M/L length of successful cases and failed cases (P > .05).

RESULTS:
Twenty-three patients (15 men, 8 women; 12 right knee, 11 left knee) with an average age of 32.1 years (range, 15-53.7 years; SD, 11.4) met the inclusion criteria. Mean follow-up was 8.48 years (range, 6.75-11.18; SD, 1.2). There were thirteen (56.5%) medial allograft meniscal transplants and ten (43.5%) lateral allograft meniscal transplants. Eight (34.8%) of the menisci were transplanted in isolation during the original procedure, while the remaining 15 (65.2%) menisci were combined with concomitant procedures. Post-operative SF-12 PCS and MCS scores showed improvement from mean pre-operative values of 39.35 and 40.26 to 49.46 and 49.52, respectively (P < .05). Similarly, mean Lysholm scores improved from 53.18 to 73.39 (P < .05). IKDC scores improved from 41.29 to 60.57 (P < .05) and a significant improvement in all five KOOS categories was observed: 58.33 to 78.50 for Pain; 50.37 to 73.91 for Symptom; 74.16 to 86.83 for ADL; 32.14 to 59.57 for Sports; 31.25 to 54.35 for QOL (P < .05 for all).

The mean post-operative satisfaction rate was 86.2% out of 10.

Moreover, 87% of the patients stated that they would elect to have this surgery again. Subgroup analysis of medial and lateral meniscus transplantation revealed greater subjective improvements for medial meniscus transplantation in the categories of SF-12 PCS, Lysholm, KOOS Pain, KOOS Symptom, KOOS ADL, and KOOS QOL. Meniscal allograft transplantation performed concomitantly with other procedures demonstrated a greater improvement in SF-12 PCS, Lysholm, IKDC, KOOS Pain, KOOS Symptom, KOOS ADL, and KOOS QOL scores compared to meniscus transplantation performed in isolation.

Three patients in this cohort underwent revision procedures and were considered to be failures. The mean age of these 3 patients was 38.2 years (range, 16.8-55.4; SD, 19.6). Statistical analysis showed that there was no significance between patient age of successful cases and failed cases (P > .05). The mean A/P length of the 23 successful allograft menisci was 40.87 mm (range, 31-50; SD, 5.4), and the mean M/L of the successful allografts was 33.59 (range, 28-39; SD, 2.8). The mean A/P length of the failed allograft menisci was 41.87 mm (range, 35-49.9; SD, 7.5), and the mean M/L of the failed allografts was 35.83 mm (range, 33-38; SD, 2.6). Statistical analysis showed that there was no significance between the allograft A/P length or M/L length of successful cases and failed cases (P > .05).

DISCUSSION:
Every patient reported improvement on all validated surveys post-operatively. Additionally, analysis of our cohort demonstrated maintained levels of improvement at 7-years post-operative when compared to 2 and 4 year follow-up scores. Based upon this data, it appears that allograft meniscus transplantation is a durable treatment option for meniscus deficient patients. It is effective in reducing pain, increasing range of motion and improving joint function in the long-term. Medial meniscus transplantation demonstrates greater subjective improvements than lateral meniscus transplantation. Subgroup analysis of isolated versus combined procedures demonstrates that patients receiving a combined procedure report greater subjective improvements than ones receiving the transplantation in isolation, supporting the need to address all concomitant pathology.

Post-operative physical examination revealed minimal pain and effusion with near-normal range of motion. Radiographic evaluation demonstrated consistent successful bony integration of the bone plugs/bridge from the allograft meniscus. Data collected on the 3 reported allograft transplantation failures demonstrated that patient anatomy and life-style play an important role in allowing for an optimal outcome. While the results of this long-term study are encouraging, further research is needed to better assess the extent that allograft meniscus transplantation has in preventing the progression of osteoarthritis and maintaining an improved level of pain and function.

REFERENCES: