

Systematic Review

Are Outcomes After Meniscal Repair Age Dependent? A Systematic Review

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Purpose: To determine if the failure rate and functional outcome after arthroscopic meniscus suture repair are age dependent. **Methods:** A systematic review was conducted using a computerized search of the electronic databases MEDLINE and ScienceDirect in adherence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Extracted data from each included study were recorded on a standardized form. Studies were included if they (1) were English-language studies in peer-reviewed journals, (2) used a distinct age cut-off to evaluate outcome of meniscal surgery for those above and below the specified cut-off, and (3) used meniscal repairs using suture based technique with inside-out, outside-in, or all-inside techniques. Review papers, case reports, technique papers, non-English language publications, abstracts, and data on meniscal repairs using meniscal screws, arrows, or darts were excluded. **Results:** 15 of 305 identified articles met the inclusion/exclusion criteria. There were 1,141 menisci treated in 1,063 patients. Seven and 8 studies met the inclusion/exclusion criteria for analysis for the age thresholds of 25 years and 30 years, respectively, demonstrating no difference in failure rates relative to age threshold. Four of 6 studies that met analysis criteria found no difference in failure rates above or below an age threshold of 35 years. No significant difference in failure in patients younger than 40 than patients older than 40 was found for 4 of the 5 studies in that arm of the review. **Conclusions:** Analysis of the composite data in this systematic review reveals that no significant difference exists when evaluating meniscal repair failure rate as a function of age above or below the given age thresholds. **Level of Evidence:** Level IV, systematic review of level III and IV studies.

Meniscal tears are one of the most common injuries of the knee with an incidence of acute meniscal tears of 61 per 100,000.¹ Meniscal tears may be due to trauma or degenerative causes.² The preferred approach for surgical treatment of meniscal tears has changed markedly over the last 30 years.³ In

1948, Fairbank showed the progressive flattening of the condyle, narrowing of the joint space, and ridge formation after total meniscectomy, but this remained the treatment until the 1970s.⁴ Abrams et al.⁵ found a significant increase in meniscus repairs performed from 2005 to 2011: incidence of meniscectomies increased by 14% whereas the incidence of meniscus repairs increased by 100% during that time. Improvements in arthroscopic surgical techniques to assess and treat meniscal pathology along with a better understanding of the biomechanical and chondroprotective properties of the menisci have resulted in a shift toward preservation of the menisci.⁶⁻⁸

When considering meniscus repair, a number of different variables are considered including location (especially in proximity to the blood supply), morphology, and chronicity. Peripheral tears in the outer one-third are in a more vascular zone with better healing potential.⁹ Tears that are less than 2 cm in length and vertical longitudinal tears have better healing rates with repair.¹⁰ Acute tears have also been shown to have higher healing rates with repair.¹⁰

The reason that this study was undertaken is that there is conflicting literature as to the effect of patient age on surgical outcomes after meniscal repair. Various

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authors have proposed age cutoffs for considering repair of the meniscus.¹¹ This in part may stem from changes seen in healing potential with senescence and that menisci may undergo age-related changes that affect healing ability as seen in other tissues in the body.^{12,13} Alternatively, the factor of chronological age may be more related to health and integrity of the meniscus itself. Currently, no consensus exists on the effect that age independently has on meniscus repair, and there have been studies that have both supported and refuted the role that age independently may play in healing potential and outcomes after meniscus repair.¹⁴⁻¹⁷ Steadman et al.¹⁵ reported no statistically significant difference in meniscus repair failure rate or in outcome scores when comparing patients younger than 40 versus those older than 40. Raza et al.¹⁴ reported that patients with excellent results based on Lysholm score were relatively young, being less than 50. Barrett et al.¹⁶ found that meniscal repair in patients 40 and older is an effective treatment with proper meniscal tear selection and surgical technique. Pujol et al.¹⁷ showed that after open meniscal repair of horizontal meniscal tears, there was a significant decline in functional results in patients older than 30.

The purpose of this study was to conduct a systematic review of the available literature to determine if the failure rate and functional outcome after arthroscopic meniscus suture repair is age dependent. Our hypothesis was that meniscus repair failure rate will differ based on age at time of index surgery for appropriately selected patients.

Methods

A written protocol was developed in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to conduct a systematic review and meta-analysis of the available literature.¹⁸ MEDLINE and Science Direct electronic databases were searched for relevant studies with the primary search terms “Meniscal Repair” OR “Meniscus Repair” and secondary search terms “Age” OR “Old,” “Young” OR “Older” OR “Younger” on October 31, 2016. Inclusion criteria included (1) English-language studies in peer-reviewed journals, (2) used a distinct age cut-off to evaluate outcome of meniscal surgery for those above and below the specified cut-off, and (3) meniscal repairs done using suture-based technique with inside-out, outside-in, or all-inside techniques. Review papers, case reports, technique papers, non-English language publications, abstracts, and data on meniscal repairs using meniscal screws, arrows, or darts were excluded. The references of articles that met inclusion/exclusion criteria were also hand reviewed to ensure any additional relevant studies were not missed. Duplicates were removed from the results of each of the 3 separate searches. The titles and abstracts for all of the

studies were then screened by the senior author (A.D.) to ensure relevance to our study questions. Each relevant study manuscript and full text was then reviewed by the senior author and assessed using our inclusion and exclusion criteria for appropriateness for qualitative and quantitative analysis in our study. A diagram of our search methodology can be found in [Figure 1](#).

Data Extraction

Data were extracted from studies and stratified based on patient-reported outcomes and retear rates above and below a specified age. A variety of failure methods were reported. Failure included residual cleft greater than 50% on second look arthroscopy, clinical symptoms, less than excellent Lysholm score, or need for subsequent surgery. A standardized form was used to assist in data extraction. Conflicts identified in the relevant data were reconciled by consensus agreement of the reviewers. An Excel database was created to compile extracted data from each study. The level of evidence of each article was assessed using the 2003 *Journal of Bone and Joint Surgery* definitions for orthopaedic publications.¹⁹ Preoperative patient characteristics such as age, gender, and laterality of meniscal injury were recorded when available. Study characteristics including anterior cruciate ligament reconstruction, operative technique, method of assessment, definition of failure, and postoperative length of follow-up were also noted.

Statistics

A 2-by-2 contingency table was created from each study based on the age specified and outcomes evaluated in the study. Calculations were performed using R statistical software.²⁰ Because of study heterogeneity, statistical comparison of weighted means was not performed for the studies included only in the systematic review. Furthermore, there were not enough data and studies reporting homogenous treatment effects to perform a meta-analysis for the subgroups.

Quality Assessment

The Newcastle-Ottawa Scale (NOS), developed to assess the quality of nonrandomized studies, was used to assess the studies included in the review. Two reviewers (S.R. and D.S.) independently reviewed the included articles. Reconciliation was performed for any discrepancies identified between scores from the 2 authors. NOS results are displayed in [Table 1](#).

Results

Study Selection

Our search on October 31, 2016, initially identified a total of 627 citations. After eliminating duplicate studies, 305 articles remained. Of these, 214 studies

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