

Risk factors of adhesion after autologous chondrocyte implantation of the knee

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Purpose

In recent years, autologous chondrocyte implantation (ACI) has become a widely used technique for treating full-depth articular cartilage defects. ACI can provide a hyaline cartilage repair, which should improve long-term durability and potentially prevent the onset of late osteoarthritis¹⁾. ACI is a well-established therapy, and various groups have reported good to excellent results in clinical follow up²⁾. However, complications associated with ACI, such as hypertrophy of the transplant, delamination of the graft, and the development of adhesion, have been known³⁾. Adhesion is also known as arthrofibrosis, and it can lead stiffness and reduction of range of motion in the knee joint, which may requires an additional arthroscopic surgery to remove the adhesion. Until now, little has been known about the risk factors of the development of adhesion after ACI. The aim of this study is to investigate risk factors of the development of joint adhesion after ACI of the knee.

Materials and Methods

We reviewed 232 patient cases with knee ACI operated on from 1995 June to 2006 December, which had undergone second-look arthroscopy after the initial ACI surgery. All patients were examined with magnetic resonance imaging before the second-look arthroscopy. One hundred twenty-seven males and 103 females were included in this study. Ages ranged from 14 to 57 years old, mean age was 36.6. These cases were categorized into two groups: adhesion group and non-adhesion group. The incidence between the two groups was compared using the following factors: age, gender, number of grafts, location of grafts, size of graft, harvest site of the periosteum, defect types, and additional operations. Defect types were divided into three groups, simple, complex, and salvage, based on the complexity of the cartilage repair and the joint status. Simple group included knees with unipolar, isolated lesions of a weight-bearing femoral condyle without chondromalacia elsewhere in the joint. Complex group included knees with single or multiple lesions of any surface with concomitant osteotomies, ligament repair or staged bone graft, but no chondromalacia elsewhere in the joint. Salvage group included knees with single or multiple lesions of any surface with evident osteoarthritis or bipolar or "kissing" lesions⁴⁾. The chi square test was used to determine the significance of the differences. Additional operations were divided into two procedures, tibial realignment and lateral release. Tibial realignment included high tibial osteotomy for patients with femoro-tibial joint malalignment or tibial tuberosity osteotomy for patients with patello-femoral joint malalignment. Lateral release included lateral retinaculum release for patients with lateral instability of patello-femoral joint or chondromalacia of patello-femoral joint.

Results

There were 91 knees in the adhesion group and 139 knees in the non-adhesion group. Mean age was 38.0 in the adhesion group and 35.8 in the non-adhesion group. Females comprised 57.1% of the adhesion group and 54.0% of the non-adhesion group. One hundred twenty one knees had one ACI grafts, 70 knees had two grafts, 31 knees had 3 grafts, and 8 cases had 4 grafts. Two and more grafts showed significantly increased incidence of adhesion ($p < 0.05$). ACI at the patella and the trochlea showed significantly increased incidences of adhesion ($p < 0.01$ for the patella and $p < 0.05$ for the trochlea). Additional lateral retinacular release to ACI significantly increased incidence of adhesion ($p = 0.001$). Other factors didn't reveal any significant difference between the two groups.

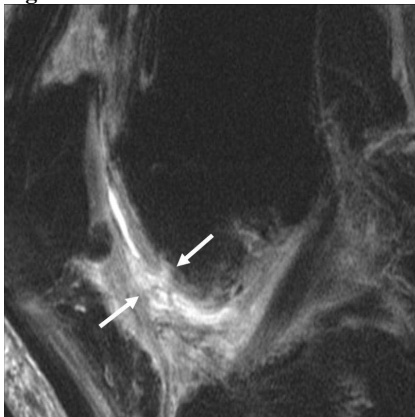
Discussion

Intra-articular adhesions requiring arthroscopic release has been reported in 5% to 10% of ACI patients. The incidence of adhesions observed in this study was 39%, which was higher than that reported previously. The reason of the high incidence of adhesion observed in this study might be that we included relatively slight adhesion observed with second-look arthroscopy, which did not require additional arthroscopic arthrolysis. It should be noted that the incidence of adhesions following ACI is almost comparable to that following anterior cruciate ligament reconstruction (4 to 35 %) ⁵⁾. In this study, two and more grafts, implantation at patellofemoral joint, and additional lateral release procedure appear to be risk factors of adhesion after ACI of the knee. The more extensive and invasive cartilage repair procedure, as well as anatomical and biomechanical characteristics of the patellofemoral joint might be a stimulator for the formation of adhesion. Adhesion may cause periosteal hypertrophy and delamination of graft by attaching to the graft directly or secondary inflammation within the joint. Further improvement of surgical method and implant used for ACI should be needed to prevent the occurrence of adhesion.

Conclusion

The two and more grafts, implantation at patellofemoral joint, and additional lateral release procedure appear to be risk factors of adhesion after ACI of the knee.

Figure 1



References

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Figure 1

Fat-suppressed proton density weighted image shows adhesions at the patellar fat pad and the trochlea ACI graft (arrows).