The effects of meniscal allograft transplantation on articular cartilage
Rijk, P.C.

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Chapter 9

Summary and Conclusions
In chapter 1 the aims of the present thesis are formulated. First, to review the literature on meniscal allograft transplantation. Second, to evaluate radiologically, scintigraphically, histologically, and biochemically changes in articular cartilage after immediate and delayed meniscal allograft transplantation in rabbits and to compare these changes with those in articular cartilage after meniscectomy only. Third, to evaluate structural changes in meniscal allografts after transplantation.

In chapter 2 a review is presented about the function, anatomy, and composition of the meniscus, followed by the history of surgery of meniscal tears and the healing of meniscal allografts in experimental and clinical studies. In addition, issues concerning preservation techniques, immunological reactions, sizing, disease transmission, indications, surgical techniques, graft fixation, rehabilitation, and complications are taken into consideration. It can be concluded that the use of meniscal allografts in clinical practice has progressed to a point where relief of pain may be expected on a short-term basis, whereas the clinical outcome on a long-term basis remains uncertain.

In chapter 3 a study is described in which radiography is used to compare degenerative changes of articular cartilage in rabbit knees after meniscectomy and after immediate or delayed meniscal transplantation. In conclusion, radiographic evaluation demonstrated that meniscal allograft transplantation performed immediately after meniscectomy does not prevent degenerative changes of articular cartilage at 1 year postoperatively when compared to total meniscectomy. Delayed meniscal transplantation, although not statistically proven, may even lead to more degenerative changes than meniscectomy only.

In chapter 4 a study is presented in which scintigraphy is used to evaluate degenerative changes in rabbit knees after meniscectomy either or not in combination with immediate or delayed meniscus transplantation. In conclusion, scintigraphic evaluation demonstrated that immediate meniscal allograft transplantation does not result in a significant protecting effect on articular cartilage against osteoarthritic degeneration on a long-term basis. It also demonstrated that delayed meniscal transplantation induced even more degenerative changes of articular cartilage than meniscectomy without transplantation.

In chapter 5 a histological study is described that evaluated whether immediate or delayed transplantation of the medial meniscus can protect rabbit knees from degenerative changes after meniscectomy. It is concluded that meniscal allograft transplantation immediately after meniscectomy has a protecting effect on articular cartilage on a long-term basis, whereas delayed transplantation results in more degenerative changes than meniscectomy only.

When the histological analysis is taken as golden standard, it can be concluded that of both noninvasive diagnostic modalities, radiography and scintigraphy, the latter is the more accurate, sensitive, and reliable technique.

In chapter 6 a quantitative histochemical analysis is described of the functional changes in the remainder of the articular cartilage in rabbit knees following
meniscectomy with or without immediate or delayed meniscal transplantation. Vitality of chondrocytes was determined on the basis of their lactate dehydrogenase activity and the quality of the extracellular matrix was determined by measuring the proteoglycan content in cartilage on the basis of the intensity of Safranin O staining. It is concluded that immediate meniscal allograft transplantation in rabbit knees did not significantly reduce degenerative changes of articular cartilage when compared with meniscectomy only, whereas delayed meniscal transplantation induced even more degenerative changes in the remainder of the cartilage than meniscectomy only.

In chapter 7 a structural analysis is performed to compare long-term performance of meniscal allografts transplanted immediately after meniscectomy and allografts transplanted at 6 weeks after meniscectomy in rabbit knees. In conclusion, our findings suggest that delayed meniscal allograft transplantation leads to more graft shrinkage than immediate allograft transplantation, whereas no clear differences in histological architecture were observed between both groups.

In chapter 8 meniscus regeneration and alternative treatments to meniscal allograft transplantation are reviewed and evaluated as well as the effects of meniscal allograft transplantation on articular cartilage. Remaining questions and future directions are considered in a final discussion.

The success of meniscal allograft transplantation must not be judged solely on the basis of incorporation of the transplant into the host knee, but must be evaluated on the basis of protective effects of the transplant on articular cartilage. Furthermore, distinction must be made between knees subjected to meniscal transplantation immediately after meniscectomy and knees that underwent delayed transplantation. Based on the data presented in the present thesis, it can be stated that both immediate and delayed meniscal transplantation in rabbits show good incorporation of the graft. However, delayed meniscal allograft transplantation leads to more graft shrinkage than immediate allograft transplantation. Histological evaluation shows that immediate meniscal transplantation has a protecting effect on articular cartilage, although this finding could not be confirmed by radiographic, scintigraphic, and histochemical studies. In any case, delayed meniscal transplantation induced even more degenerative changes than meniscectomy only. It is concluded that considerably more data and evaluation of results are needed to determine whether meniscal allograft transplantation in humans will be successful in protecting and preserving articular cartilage after meniscectomy on the long term, but it is clear from the present study that delayed transplantation has to be considered with great care.