The Journal of Bone and Joint Surgery

EDITORIAL

CARBON FIBRE AS A SURGICAL IMPLANT

Many recent developments in orthopaedic surgery have themselves been made possible as a result of earlier developments in the field of materials technology, and carbon fibre is one such new material which has been the subject of a good deal of recent animal experimentation. It is interesting therefore to note that in this issue of the Journal there are two papers which report the translation of the results of such work into clinical practice.

The paper by Howard *et al.* (page 206) describes the use of the material in patients with neglected ruptures of the calcaneal tendon, the site where it was first used experimentally by Jenkins *et al.* in 1977. Tendons do of course have the ability to heal when their ends are apposed, but where there is an otherwise unbridgeable gap it would appear that the carbon fibres have the capacity to conduct repair tissue between the tendon ends. However, the healing capacities of lower animals often exceed that of their human counterparts so that it is reassuring to find that the human calcaneal tendon behaves in the same way as that of the sheep.

There are of course a number of existing techniques for bridging late defects in the human calcaneal tendon using the patient's own tissues, and Howard and his colleagues have been careful to put their results in perspective by comparing them with one of the most successful series of these; indeed, since the results were very comparable, one must inevitably ask what has been gained by substituting an implant?

The authors themselves point out that the only real advantage is one of surgical simplicity. Many of the existing techniques are extremely elaborate, involving long incisions in the calf to obtain strips of the gastrocnemius, sacrifice of other tendons such as the peroneus brevis and even separate incisions to obtain fascia lata. The procedure described here obviously offers

an economy in surgical time and, more important, the extent of surgical scarring. Details of technique are obviously not important since all the cases were operated on by different surgeons, each presumably using the procedure for the first time and no doubt employing slightly different methods.

On the debit side one has to remember that the method involves a foreign implant which, in the event of deep infection, would probably require complete removal with consequent failure of the repair. The region over the calcaneal tendon is notorious for skin breakdown and although none such occurred in this series there were only five cases and it is noteworthy that one of these took over a year to heal. Only further experience will reveal the true incidence of this theoretical complication and whether it outweighs the undoubted simplicity and convenience of the method.

The paper by Leyshon *et al.* (page 196) deals with another specific use of the material, this time as a ligament replacement around the knee, and again the results have been compared with conventional techniques using the patient's own tissues. The arguments which arise are very similar to those already rehearsed. The method does not appear to offer anything which is not available by alternative techniques but once again it is undoubtedly simpler and it is also possible to repair more structures at a single sitting. The same theoretical objection with regard to deep infection of course remains and the writer is aware of a number of instances where removal has been necessary on this account, although there have apparently been none in this series.

The role played by the carbon in this situation is less clear than in the calcaneal tendon. Experimentally the amount of collagenous infiltrate is much less in these circumstances, and the authors acknowledge from their arthroscopic findings that in the case of the cruciate ligaments the appearance of total replacement is often

illusory and nothing more than a surface covering is present; similar observations have been made by Dandy and his colleagues (1982). The evidence for collateral ligament regeneration is based on the palpation of thickened cords around the joint, and while this is certainly impressive clinically we have not as yet sufficient histological confirmation from human material to assess how much of the success of the implant depends on new ligament formation and how much on its role as a prosthesis.

From the evidence of studies to date it would seem that so far as the cruciate ligaments are concerned the effectiveness must be largely prosthetic, and while this was perhaps not the original intention in inserting the implants their clinical success cannot be dismissed. Even if they do act largely as prostheses they are at least firmly self-anchoring, which solves a considerable problem in prosthetic ligament surgery. The fact that there were no late ruptures in cases followed as long as four years suggests that it is a durable prosthesis, and it is of course possible that with the further passage of time the collagenous infiltrate will increase so that the implant

will become stronger rather than weaker, as was the original intention. Once again, more experience is required before this can be confirmed.

Another unresolved question hanging over the intra-articular use of the material arises from the suggestion that the reaction of the tissues to carbon fibre within a joint is less favourable than in the extra-articular situation. There is some experimental evidence to support this and the histological studies in the present paper are not entirely reassuring. Dandy and his colleagues (1982) have reported frank synovitis in some of their cases, and although such gross changes were not seen in the present series there is an incidence of residual aching pain in the joint. This was originally reported in an earlier series of these implants by Jenkins and McKibbin (1980) but in this more long-term review it would seem that these symptoms have a tendency to settle. Nevertheless, the authors' conclusion that the material should only be used intra-articularly in severely unstable knees, which might otherwise have to be sacrificed for more radical surgery later, seems prudent at the present time.

B. MCKIBBIN

B. McKibbin, MD, MS, FRCS, Professor of Traumatic and Orthopaedic Surgery, Cardiff Royal Infirmary, Cardiff CF2 1SZ, Wales.

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