TENDON GRAFTS

In 1860 William Adams of London wrote: "Tendon is one of the few structures of the body, such as bone, cellular tissue, nerve tissue and blood vessels capable of reproduction or regeneration. The perfection of the process is in direct proportion to the absence of extravasated blood and inflammatory exudate. The sheath of the tendon, when consisting of loose textured areolar tissue, as in the tendo calcaneus, and other tendons surrounded by soft tissues, is of importance in preserving a connection between the divided extremities of the tendon; in furnishing the matrix in which the nucleated blastematous, or proper reparative, material is effused: and in giving definition and form to the newly developed tendinous tissue. The ultimate perfection of the reparative process is marred only by the adhesions of the deep surface of the new tendon to a greater or less extent with the neighbouring fibro-cellular tissue. These adhesions may limit the free play of the tendon, but will not interfere with sufficient motion being obtained."

Since these words were written, many investigations have been made into the nature of tendon healing and the behaviour of autogenous tendon grafts. The true facts concerning these processes in the human are not yet fully known, and even in carefully controlled animal experiments the results have been conflicting. Nevertheless, there is considerable confirmation of Adams’s views.

Mason and Shearon (1932), while studying tendon healing in dogs, came to the conclusion that a graft maintains its vitality and unites to the host tendon by proliferation of the sheath tissue or the paratenon. They believed that this early union was completed by actual growth of the tendon cells (tenoblasts) from the ends of the tendon and the graft. Skoog and Persson (1954), working on rabbits, found that undifferentiated connective tissue arising from paratenon filled the gap between divided tendon ends and gradually matured to final union. They were unable to demonstrate any regenerative process arising from the tendon itself. They found that the cells in a free graft degenerate and that part, at least, of the graft is replaced by cells which infiltrate from the paratenon. Flynn, Wilson, Child and Graham (1960) confirmed the observation that union between host tendon and graft in dogs is effected mainly by proliferation of sheath or paratenon tissue, and found no evidence of tendon cell activity in the graft. On the contrary, they demonstrated complete ischaemic necrosis of the graft, which was subsequently invaded by tenoblasts from the host tendon until there was finally complete replacement of the grafted tendon. Lindsay and McDougall (1961) used the chicken’s foot on account of the anatomical similarity between the digital flexor arrangement of chicken and man. They found that a graft survives as a whole, but although they demonstrated a process of repair consisting of revascularisation, increase in mature fibroblasts and gradual replacement or reconstitution of the original collagen, they found it impossible to determine the source of the cells which repopulated the graft.

Clinical experience supports the view of graft survival in man, because it is difficult otherwise to account for the rarity of rupture of the graft upon which considerable strain is placed long before reconstitution can occur. Peer (1955) took the view that the tendon cells
and stromal cells of a human graft survive, nourished by the rapid revascularisation which is known to occur. His opinion was based upon the examination of autogenous grafts buried in the abdominal fat. An active circulation was established within the graft in four to five days. Grafts were examined at intervals up to twenty-five days and after a lapse of seven and eight months. In no case could any evidence be found of invasion by fibroblasts from the surrounding tissue, and Peer concluded that the graft tendon cells must have survived as such unless they had been replaced by the fibroblasts in the connective tissue stroma of the graft.

An interesting and important observation emerging from the work of Skoog and McDougall is that any damage—even the passing of a suture and immediate withdrawal—to the epitenon (the thin adherent fibroblastic layer upon the tendon) leads to dense adhesions between tendon and surrounding tissues, thus restricting movement. Skoog, in particular, refutes the traditional view that it is the unsatisfied tendon ends which reach out to attach themselves to other structures. He calls attention to the common clinical observation that when a cut tendon end withdraws into an undamaged synovial sheath no significant adhesions are formed.

Brand’s extensive experience in the use of free tendon grafts in the treatment of the paralytic hand of leprosy has led him to formulate certain rules for the operation of tendon grafting. The success of his operation for ulnar palsy has proved their value, but not all of these rules can be applied to the standard operation of graft replacement for divided flexor tendons in a digit. If they could be applied, the results would undoubtedly be improved. Even so, Brand’s rules should be followed, whenever it is possible to do so, because they are in keeping with the experience gained from experimental and clinical work. It is fortunate that men like Brand and Riordan have shown how the principles and techniques of modern hand surgery can be applied to the treatment of this ancient but still widely prevalent disease. There are over ten million sufferers from leprosy in the world today and there is a great need for surgeons to become interested in this problem. They would find it a fascinating and rewarding task. Not only is there a vast amount of reparative surgery and research waiting to be done but there is also the need to train the leprosy patient in the care of the anaesthetic hand and foot and to help him back to his place in the community.

The hopes of many men, women and children rest on the orthopaedic and plastic surgeons of those countries where the disease is endemic. In the countries where there are no centres for reconstructive surgery men trained in these concepts are needed to develop this work.

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REFERENCES