

Free Autogenous Grafts into the Penile Cavernous Tissue

An Experimental Study in Dogs

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Summary. The behaviour of free autogenous fat, dermofat, and dermo grafts in the penile cavernous tissue was studied experimentally in dogs. Dermo-fat grafts were those most easily manipulated during surgery and allowed perfect haemostasis. All the grafts were gradually replaced by fibrous tissue causing subsequent scarring and contraction. This reaction was least noticeable with dermis grafts. Cavernous transformation of the adipose tissue was not observed. For the surgical correction of Peyronie's disease the use of a dermo-fat graft is suggested. The grafts should be slightly larger than necessary to allow for the subsequent fibrosis, and the layer of fat should be kept very thin.

Key words: Penile cavernous tissue, Autogenous grafting, Penile induration, Dermo-fat graft, Skin grafts.

In plastic induration of the penis (Peyronie's disease) there is fibrous thickening of the shaft of the penis accompanied by painful erections and an associated curvature towards the side of the induration. The disorder interferes with or even prevents normal sexual intercourse. Late results after different forms of traditional treatment such as local cortisone injection, vitamin E or irradiation are often disappointing and give no better result than the natural history of the disease (1). For many patients surgery offers the only hope of a cure and various surgical techniques have been suggested (2, 5, 6, 7). Most procedures involve surgical excision of the plaque and repair of the resulting defect in the tunica albuginea and underlying cavernous tissue. Although various types of grafts have been suggested there is no agreement as to which is the most suitable. The subsequent changes which take place in these grafts on their richly vascularized bed remain uncertain. In an attempt to elucidate these changes an experimental study was performed in dogs.

Material and Methods

The experiments were performed on nine mongrel dogs. Anaesthesia was induced and maintained by thiopentone sodium given intravenously. After endotracheal intubation the animals were ventilated with a 60 % nitrous oxide in oxygen mixture with an Engström respirator (LKB Medical, Stockholm, Sweden). The preputium of each animal was incised and a 1 cm square piece of the tunica albuginea with its underlying cavernous tissue was removed. The resulting defect was repaired in one of three ways:

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|----------|-----------------|----------|
| Group 1: | Fat graft | (3 dogs) |
| Group 2: | Dermo-fat graft | (3 dogs) |
| Group 3: | Dermo graft | (3 dogs) |

The grafts were taken from the inguinal region which a previous pilot study had demonstrated to be a suitable donor site. They were

immediately transferred to their recipient site in order not to lose their moist coverings and sutured in place with interrupted catgut stitches. The preputium was repaired in two layers to secure good haemostasis. No urethral catheters or supportive dressings were used. Biopsies were taken after 6 weeks, 4 months and 6 months and examined following staining with haematoxylin-eosin as well as Hansen's connective tissue stain (8). The viability of the fat grafts was also evaluated by measurement of glycerol release produced by incubation with noradrenaline *in vitro* (4).

Results

The dermo-fat grafts were those most easy to manipulate and suture during surgery, besides permitting perfect haemostasis. The fat grafts also allowed good haemostasis but they were rather brittle to handle and suture. Haemostasis was less reliable after dermo grafts but they were easy to handle and suture.

Following suture the grafts looked rather bumpy and rough on surface appearance (Fig. 1) but nevertheless all grew well and were nicely healed after 6 weeks, without any infection or sloughing (Fig. 2). In surface appearance all the grafts simulated the normal adjacent tunica albuginea, and neither cyst formation from adnexal glands nor fat necrosis were noted. All the grafts showed increased consistency on palpation, but after 6 weeks this was most pronounced for the fat and dermo grafts. After 4 months there was increased fibrosis in all three types of graft without significant individual differences (Fig. 3). Scarring and contraction were still more pronounced at 6 months (Fig. 4), but now the dermo grafts appeared more pliable and softer than those of fat- and dermo-fat. The grafts were easily distinguished from the surrounding cavernous tissue by their yellow-white colour and firmer consistency.

Glycerol release following incubation with noradrenaline *in vitro* in both fat grafts and control fat taken from the inguinal region (donor site) is shown in Tables 1 and 2. The responses were similar after 6 weeks and 6 months and showed no significant rise in glycerol, output from the fat grafts, indicating that the fat tissue had lost its normal metabolism).

The results of histological examination of the biopsies were in close agreement with the glycerol release findings as well as the gross appearance of the various grafts. The microscopical appearance was that of a gradually increasing fibrosis in which no conclusive difference could be observed between the three types of graft (Figs. 5 and 6).

All the grafts were gradually transformed first into a loose but later more coarse fibrous tissue. Normal fat cells could not be observed with certainty and neither could cavernous transformation of the adipose tissue be seen.

Discussion

Horton & Devine (3) scrutinized grafts of vein, artery and dermis as well as autogenous fascia as a substitute for the penile tunica albuginea in dogs and found that all except dermis contracted and scarred. Had they followed their results for more than 16 weeks, scarring and distortion would probably have been present even in the dermis grafts. The present study showed the various grafts to be gradually replaced by an initially loose but eventually dense fibrous tissue. Chemical and histological studies also showed that the transplanted fat did not survive in a biologically active form but was gradually transformed into scar tissue.

That dermo grafts showed the least degree of contraction and scarring at 6 months may be

Table 1. Glycerol release in normal adipose tissue (control) and in fat grafts at 6 weeks, stimulated by incubation with isopropyl-noradrenaline (ISPNA)

Glycerol release $\mu\text{mol}/\text{per gram wet weight}/2\text{h}$		
Conc. ISPNA molarity	Control value	Fat graft 6 weeks
0	0.61 ± 0.10	0.10 ± 0.02
10^{-7}	1.57 ± 0.27	0.11 ± 0.00
10^{-6}	10.18 ± 0.08	0.10 ± 0.04

Table 2. Glycerol release in control fat and fat graft at 6 months

Glycerol release $\mu\text{mol per gram wet weight} / 2\text{h}$		
Conc. ISPNA molarity	Control value	Fat graft 6 months
0	0.57 ± 0.09	0.12 ± 0.02
10^{-6}	2.92 ± 0.34	0.42 ± 0.16

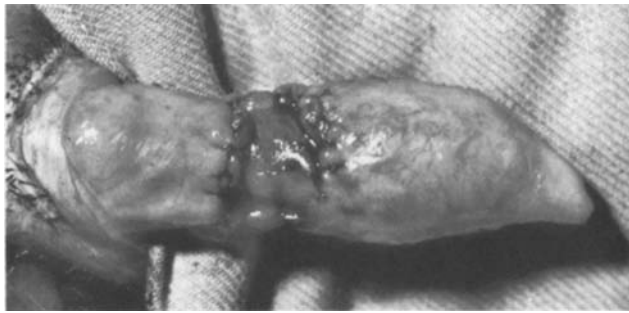


Fig. 1. Dermo-fat graft after completed suture

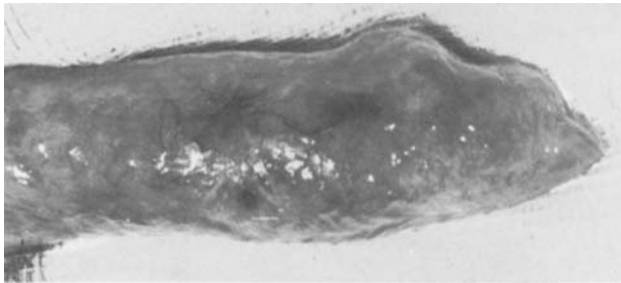


Fig. 2. Dermo-fat graft after 6 weeks. The graft is nicely healed and difficult to distinguish from the adjacent normal tissue



Fig. 3. Fat graft after 4 months. The graft is replaced by stellate fibrosis and moderate contraction is seen

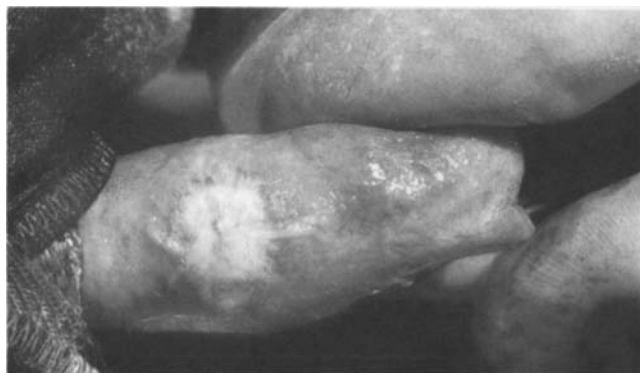


Fig. 4. Fat graft at 6 months. The graft is replaced by dense fibrous tissue

due to their lack of an accompanying fat layer. Judged by this criterion a dermograft should be the most suitable for the surgical correction of Peyronie's disease. Haemostasis, however, was less satisfactory after dermo grafts and for this reason a dermo-fat graft with a very thin fat layer appears to be more suitable. To compensate for the contraction of the grafts due to scarring, they should be of somewhat larger size than the defect produced in the tunica albuginea by excision of the induration.

In 1971 Thompson (9) demonstrated the improved survival of muscle grafts by preliminary denervation of the muscle before transplantation. If preliminary deervation of the donor area would also improve the survival of dermo-fat and dermo grafts into the penile cavernous tissue is not known, but is presently being studied in our laboratory.

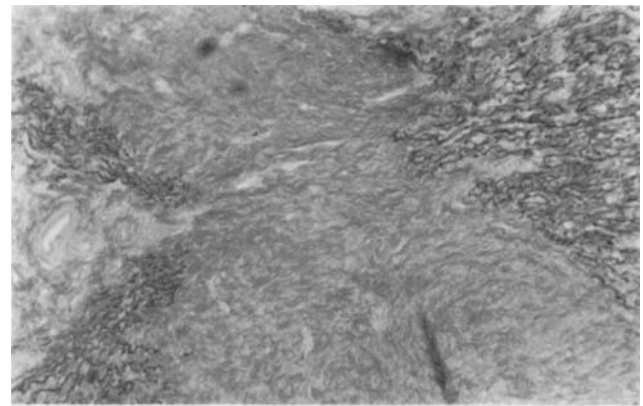


Fig. 5. Dermo-fat graft at 6 weeks. The transplant which is located in the middle of the figure is composed of loose connective tissue lacking elastic fibres. Large amounts of elastic fibres are found in the surrounding tissue. Hansen-van Gieson x 100

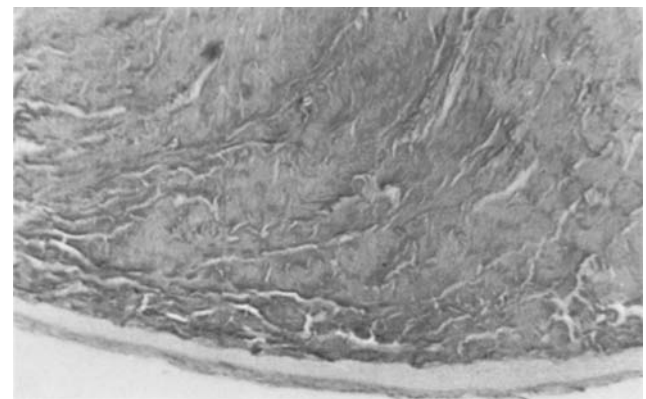


Fig. 6. Fat graft at 6 months. The transplant is covered with a thin layer of squamous epithelium and consists of coarse bundles of collagen fibres. Hansen-van Gieson x 100

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