Does a ‘firebreak’ full-thickness skin graft prevent recurrence after surgery for Dupuytren’s contracture?

A PROSPECTIVE, RANDOMISED TRIAL

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We randomised 79 patients (84 hands, 90 fingers) with Dupuytren’s contracture of the proximal interphalangeal joint to have either a ‘firebreak’ skin graft (39 patients, 41 hands, 44 fingers) or a fasciectomy (40 patients, 43 hands, 46 fingers) if, after full correction, the skin over the proximal phalanx could be easily closed by a Z-plasty. Patients were reviewed after three, six, 12, 24 and 36 months to note any complications, the range of movement and recurrence. Both groups were similar in regard to age, gender and factors considered to influence the outcome such as bilateral disease, family history, the presence of diabetes, smoking and alcohol intake.

The degree of contracture of the metacarpophalangeal and interphalangeal joints of the operated fingers was similar in the two groups and both were comparable in terms of grip strength, range of movement and disability at each follow-up. The recurrence rate was 12.2%.

We did not identify any improvement in correction or recurrence of contracture after firebreak dermofasciectomy up to three years after surgery.

Dupuytren’s contracture of the hand is the fourth most common disorder presenting to hand units in the United Kingdom.1,2 It is common to treat the deformity with surgical excision of the contracted fascia. Rates of recurrence of up to 50% have been reported after primary surgery.3 Operations for recurrent contracture are more demanding and include dermofasciectomy with full-thickness skin grafting.4,5 A lower rate of recurrence of between 2% and 20% has been reported when the skin is replaced.3,6 The use of a small ‘firebreak’ full-thickness skin graft has also been suggested as a means of decreasing recurrence.7

In a prospective, randomised trial, we investigated whether such a graft used after correction of Dupuytren’s contracture of the proximal interphalangeal (PIP) joint altered the rate of recurrence.

Patients and Methods

Recurrence after fasciectomy occurs in about 35%.8,9 and is much lower (8.4%) after dermofasciectomy.4 From these figures we calculated that 46 hands would be required in each group to detect a difference of 25% in rates of recurrence with a probability of 0.05 and a power of 90% and 39 hands in each group for power of 85%.3 We evaluated 121 hands in 113 patients with primary Dupuytren’s contracture greater than 30° of the PIP joint of a finger for inclusion in the study, including those with several affected fingers in the same hand. Of these 17 were excluded because they had previous surgery on the affected hand, were receiving anti-coagulation treatment or were unable to complete questionnaires, give consent or attend for follow-up. A further two were medically unwell and did not have an operation.

The study was approved by the local ethics committee and the protocol carefully explained to the patients who were also given an information sheet. They provided written and specific consent which was confirmed on admission. Seven patients withdrew consent and a further five changed their mind about having surgery. The study followed the CONSORT recommendations.10 A proforma was used to collect clinical and pre- and post-operative details.

The remaining 82 patients (94 fingers, 87 hands) were operated on by the senior authors (JJD and BB). Three hands (four fingers) were excluded, in two because the Z-plasty did not close and in one hand (two fingers) because a dermofasciectomy was performed on one finger and a fasciectomy on the second, which was a breach of protocol. The remaining 79 patients (84 hands, 90 fingers) were similar for all measured variables...
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(Table I). There were 14 women and 65 men with a mean age of 62.9 years (27 to 85). For all patients, the mean contracture of the 90 fingers was 21° (SEM 3) at the metacarpophalangeal (MCP) joint and 59° (SEM 2) at the PIP joint (Fig. 1).

The conduct of the operation was agreed beforehand. The finger was explored through a longitudinal incision. All fibrous bands and nodules were identified and recorded before their excision. After correction of the contracture a Z-plasty was performed. Careful haemostasis was achieved after release of the tourniquet and it was confirmed that the skin could be closed without tension in the 90 fingers (79 patients). Random numbers were held in sealed envelopes, and the theatre sister was responsible for selecting and noting the consecutive numbers. An even number was drawn for 40 patients (43 hands, 46 fingers) and, in these, the Z-plasty was closed. An odd number was drawn for 39 patients (41 hands, 44 fingers) and, in these, the palmar skin was excised and a full-thickness skin graft taken from the elbow flexion crease or inner side of the arm. After fenestration, the graft was secured using 5-0 Vicryl sutures to cover the defect (Fig. 2). A compressive dressing with a palmar plaster-of-Paris slab was applied. The hand was elevated in a sling overnight and the patients then discharged.

The degree of contracture, its correction and the range of movement at the metacarpophalangeal (MCP) and PIP joints were assessed by a single observer (ASU).
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pre-operatively and two weeks after surgery. The measures were repeated at three, six, 12, 24 and 36 months using a finger goniometer. The function of the hand was assessed using the Patient Evaluation Measure\(^{11}\) and grip strength noted using the same calibrated Jamar dynamometer at each visit with the same observer recording the measurements. Any post-operative complications were recorded. Because of the difference in interventions it was not possible to blind the observer to the intervention, but he did not perform the surgery.

**Statistical analysis.** The data between groups were analysed by cross tabulations and the calculation of chi-square and analysis of variance (ANOVA) using SPSS version 13 software (SPSS Inc., Baltimore, Maryland). Repeated measures ANOVA between subjects was carried out to investigate whether the measurements of contracture, movement, strength and function were different in the groups over the three years. When required the Greenhouse-Geisser correction was used.\(^{12}\) Since there were 79 patients, (84 hands, 90 fingers) we also used generalising estimating equations to assess differences.\(^{13}\)

**Results**

The mean duration of surgery was 66 minutes (35 to 130) for release of the contracture by a fasciectomy and Z-plasty and 79 minutes (35 to 130) for dermofasciectomy with a skin graft (\(p = 0.01\), ANOVA). All the MCP contractures were corrected fully whereas the PIP deformities were corrected to a mean of 6° (SEM 0.8 ) of contracture in both groups.

Eight patients with a skin graft and two without received antibiotics for five days as a precaution because of redness around the wound. In five, all with a skin graft, *Staphylococcus aureus* was grown, but none required debridement and in all the infection settled uneventfully. One patient had necrosis of the tip of the Z-plasty which was allowed to heal naturally. Four patients with a skin graft and one with Z-plasty alone had minor wound dehiscence which did not require intervention apart from the use of adhesive tapes for a week. The incidence of altered sensation in the immediate post-operative period was high, with hypoaesthesia affecting 41 of 90 fingers, one side in 28 cases and both sides in 13. Hypoaesthesia was not related to the degree of correction of the deformity, the number of bands removed, age or the duration of surgery. In all cases sensation had returned to normal at three months. Two patients had features of algodystrophy, one in each group (Table II). They were treated by physiotherapy and the condition resolved. There was one donor-site haematoma which resolved spontaneously.

The mean range of movement of the PIP joint was 34.6° (1° to 80°) pre-operatively which improved to 63°(2° to 98°) at three years (Fig. 3a).

Progressive recurrence of contracture of the PIP joint over the three years was seen in 11 fingers (12.2%). Five had a fasciectomy with Z-plasty and their contracture recurred within 5.4 months compared with eight months for those with a full-thickness skin graft (\(p = 0.6\), Wald chi-squared test, Table II).

Hand strength recovered in a similar manner in both groups (Fig. 3b). At three years, the mean score was 18, when 0 represented a normal hand (SEM 1, SD 10). This correlated well with the degree of contracture (Pearson’s correlation 0.716, \(p < 0.000\)) and movement (Pearson’s correlation -0.517, \(p < 0.000\)) of the PIP joint at three years. However, there was no difference in the groups over the period of study (Fig. 3c).

**Discussion**

McCann et al\(^{14}\) found evidence of myofibroblasts in the epi- dermal boundary and dermis overlying Dupuytren’s tissue on electron microscopy. However, VandeBerg et al\(^{15}\) showed the presence of myofibroblasts in the lower two zones of the skin over a nodule, but not in skin over a cord or in uninvolved skin. These authors suggested that a local defect in the skin of the finger might inhibit contraction of myofibroblasts and therefore excision of skin, especially over the nodule, might be indicated. Varian and Hueston\(^{16}\) noted that diseased tissue might extend under the full-thickness skin graft from unexcised tissue beneath the neurovascular bundle.

Tension in the palmar fascia can promote early recurrence and it has been suggested that Z-plasty, especially...
with a skin graft, lowers the risk of suturing skin under tension and thereby leads to a lower rate of recurrence.\textsuperscript{17}

Hueston\textsuperscript{18} observed that the rate of recurrence was lower after a full-thickness skin graft and suggested this as a primary intervention in young patients with strong Dupuytren’s diathesis. He recommended the use of strategically placed ‘firebreak’ full-thickness grafts at flexion creases of the diseased and deformed fingers.\textsuperscript{18} Tonkin et al\textsuperscript{3} observed a recurrence of 47\% after fasciectomy alone and almost none after a full-thickness skin graft in 35 patients who had this performed three years after the initial surgery.

Hall et al\textsuperscript{5} described on a series of 67 patients who had a radical dermofasciectomy and noted 8\% recurrence between 24 and 100 months after surgery. The same unit\textsuperscript{2} observed another

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<th>Table II. Post-operative complications and rates of recurrence</th>
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<td>Reflex sympathetic dystrophy</td>
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<td>Recurrence\textsuperscript{†}</td>
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\* nominal data analysed by cross tabulation. The chi-squared test is given as well as the p-value
\textsuperscript{†} recurrence assessed using the generalised estimating equation accounting for patients, hands and fingers giving the Wald chi-squared test
series of 103 patients (143 fingers) and found a recurrence of 12% at a mean of almost six months. These authors suggested that when skin was extensively involved, its excision and the application of a large full-thickness graft would achieve better disease control. Roy et al. described 79 patients (100 digits) who underwent excision of Dupuytren’s contracture bands to the mid-lateral lines of the fingers and application of a small full-thickness graft without excision of skin. At a mean follow-up of four years they noted a recurrence rate of 7%, which was similar to our findings at three years. It has been suggested that such a small skin graft should be used in preference in patients with a diathesis while fasciectomy and Z-plasty should be reserved for those over 65 years of age. Some consider that the area of skin excision matters and that radical dermofasciectomy is more likely to prevent recurrence than a smaller ‘firebreak’ fasciectomy. We find this difficult to understand especially since the recurrence rate, even without the skin graft was very low in our study.

We found no difference in recurrence rates between the two methods of treatment at three years and were surprised at the low recurrence rate after fasciectomy and Z-plasty alone. This may have been because skin was closed without tension or perhaps the recurrence was less if complete correction was achieved. It may be that correction without leaving fascia under tension beneath the skin is more important than the provision of a skin graft. Since skin grafting is more likely to be performed by a senior surgeon, the lower rate of recurrence could be associated with a more expert and complete excision of the contracted fascia.

The strengths of our study are that in all patients surgery was performed by two hand surgeons and that all were assessed by the same independent observer and the length of follow-up was adequate to identify most recurrences. The weaknesses are that it was not possible to blind the patient or observer because the skin graft was obvious. Our study has reported the results of the use of ‘firebreak’ skin graft rather than of radical dermofasciectomy. Our finding that use of such a graft did not decrease the rate of recurrence may therefore not be applicable to extensive skin excision and the use of large full-thickness skin grafts.

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References