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ROENTGENOLOGICAL STUDY OF MOVEMENTS OF THE AMPUTATION STUMP WITHIN THE PROSTHESIS SOCKET IN BELOW-KNEE AMPUTEES FITTED WITH A PTB PROSTHESIS

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At the Biomechanics Laboratories of the Amputee Research Project at the University of California, a below-knee prosthesis was introduced in 1957 which was given the name PTB prosthesis (patella tendon-bearing prosthesis) because a large part of the body weight was borne by the patella tendon. The socket of the prosthesis is constructed with so-called total contact. After 2 years' experience at Gåskolan, Uppsala University, including manufacture of PTB prosthesis for about 60 amputees, a clinical follow-up was performed. One-third of the patients stated that they had a sensation of instability when walking, and about 70 per cent of the prostheses were found to be too large (Lempert 1965).

It was considered that owing to the relatively small surfaces carrying the body weight with this type of prosthesis, excessive movement between the stump and socket, but also too close contact, could give rise to skin changes on and symptoms from the stump. Good contact between the socket of the prosthesis and the amputation stump has been found by Bleck et al. (1963), among others, to reduce the occurrence of skin lesions on the stump.

In the present investigation, movements of the stump bone and the patella in relation to the socket of the prosthesis in patients fitted with PTB prostheses were studied roentgenologically. Under four different conditions of weight-bearing, distances between the stump bone and the socket were measured and presented graphically. The roentgenological findings were correlated with

1. the patient's subjective opinion of the stability of the prosthesis,

(Table 2). Of the 32 cases belonging to type A and treated with plaster, the results were excellent or good in 29, and fair or poor in 3. Of the 18 of type B, the results were excellent or good in only 4, and fair or poor in 14.

Of the 60 fractures (7 of type A and 53 of type B) treated surgically (Table 3) the end-results were excellent or good in 30 and fair or poor in 30.

Subtaloid arthrodesis was done in 8 cases (2 belonging to type A and 6 to type B) and triple arthrodesis in 46 (2 of type A and 44 of type B).

Of the 8 cases subjected to subtaloid arthrodesis the results were excellent or good in only 2, but fair or poor in all 6 cases of type B. Of these 6 patients, 5 had been operated upon within 4 days of the accident.

Table 4. Results of operative treatment performed at various intervals after accident.

Interval between accident and operation	Type of operation	Excellent-good	Fair-poor
1-3 days	Triple arthrodesis	12	1
	Subtaloid arthrodesis	2	1
	Screw	2	
	Open reduction	2	
4-7 days	Triple arthrodesis	5	7
	Subtaloid arthrodesis		2
8-14 days	Triple arthrodesis	3	7
	Subtaloid arthrodesis		2
	Screw	1	
	Open reduction		1
15-21 days	Triple arthrodesis	1	2
21 days to 19 months	Triple arthrodesis	2	6
	Subtaloid arthrodesis		1
Total		30	30

In the 46 cases where triple arthrodesis had been performed, the results were excellent or good in 23 and fair or poor in 23. Of the 23 cases with good results, 12 had been operated upon 1-3 days after the injury, 5 after 4-7 days, 3 in the second week, 1 in the third week, and 2 still later (Table 4).

In those cases where the results were poor only 1 had been operated upon on the day of the accident, while 7 had been operated upon 4-7 days after the injury, 7 in the second week, 2 in the third week and 6 still later.

On classification of the results according to the interval between the injury and the operation it was found that of those in whom the operation was performed within 3 days of the accident the end results were excellent or good in 18 and fair or poor in 2.

In a chapter on triple arthrodesis based on material from Prof. Moberg's department in Gothenburg, *Thorén* (1964) pointed out that in the evaluation of the results it should be borne in mind that the material was selected in that it contained several cases that were severe and had therefore been referred to that special hospital for treatment.

During the period covered by the present investigation (1939-1961) the material consisted of cases from Malmöhus county and from different hospitals in the south of Sweden.

Of the 94 patients in the present material, only 58 were residents of the receiving area of the Lund Hospital. Of the remaining 36, 5 were of type A and 31 of type B. This probably means that severe fractures were referred to us from other hospitals.

The above mentioned results suggest either that early operation is preferable or that cases operated on after 4 days were severe cases with extensive injuries referred to our hospital from the peripheral region. This is in accordance with *Thorén's* discussion above.

SUMMARY

In 1939-1961 all together 123 patients were admitted to the Department of Orthopaedics because of fracture of the calcaneus. Ninety-four of these with 110 fractures (50 treated conservatively and 60 surgically) were reviewed.

For the classification *Widén's* system was used, but group V was incorporated in type A, leaving only the most severe cases (group VI and VII) in group B.

Conservative treatment. Fifty fractures, 32 of type A groups I-V i.e., extra-articular or intra-articular fracture without dislocation, treated with plaster had produced good results in 29 and poor results in 3, while in 18 of type B, i.e., intra-articular fractures with dislocation and treated conservatively had given good results in 4 and poor results in 14. Fractures of type A can thus be successfully treated conservatively.

Surgical treatment. Sixty fractures (7 of type A and 53 of type B) were treated surgically. Triple arthrodesis had been done in 46 with good results in 23 and poor results in 23, subtaloid arthrodesis in 8 with good results in 2 and poor results in 6. Three were treated with a screw, all with good results, and 3 with open reduction with good results in 2 and poor in 1.

The results and the incidence of complications appeared to vary with the interval between the injury and arthrodesis. An interval of 4-7 days between the accident and operation carries a risk of mediocre results. The best results may be expected after early surgery.

It is pointed out that 36 out of 94 patients were referred to the Orthopaedic Department in Lund from other hospitals in south Sweden and they represented fairly severe cases. 31 of the 36 cases were of type B. Like *Thorén* (1964) we suspect that this material of arthrodesis cases is selected. This must be borne in mind when judging the value of triple arthrodesis in severe calcaneal fractures.

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