A COMPARISON OF THE FREEMAN-SWANSON (ICLH) AND WALLDIUS PROSTHESES IN TOTAL KNEE REPLACEMENT

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Seventy-five Freeman-Swanson (ICLH) Mark I total knee replacements, all performed in one orthopaedic unit between 1972 and 1975, were independently reviewed. The fifty-eight surviving patients, with sixty-eight arthroplasties, have been interviewed and examined and the clinical records of the deceased patients inspected. Sixty arthroplasties (80 per cent) were successful and fifteen failed (20 per cent). There were no disasters. Twenty (33.8 per cent) of the successful arthroplasties were excellent. It is expected that modification of the prosthesis and improved instrumentation will increase this percentage of excellent results and reduce the failure rate.

The results of knee replacement by the Freeman–Swanson prosthesis have been reported previously (Freeman, Swanson and Todd 1973a, 1973b; Bargren et al. 1976; Freeman, Sculco and Todd 1977). This paper reports the experience in the use of this prosthesis from 1972 to 1975 at Norwich. All of the patients were operated upon by one surgeon or his trainees; the review has been carried out independently by two of the authors and compared with the results using the Walldius arthroplasty (Phillips and Taylor 1975). These authors noted that non-linked metal-to-plastic prostheses represented the current trend in design, offering theoretical advantages over the hinged prostheses and interposition arthroplasties; the Freeman–Swanson (ICLH) non-linked prosthesis has been used in Norwich since April 1972.

CLINICAL MATERIAL

Seventy-five ICLH arthroplasties, with the standard Mark I prosthesis, were performed in sixty-four patients. Six patients, with seven arthroplasties, have subsequently died from unrelated causes more than two years after the operation. The fifty-eight surviving patients, with sixty-eight arthroplasties, have been interviewed and examined for this review, and the clinical records of the deceased patients have been scrutinised.

The ages of the patients at the time of operation ranged from thirty-eight to seventy-four years, with a mean age of sixty-five years. There were fifty-three women and eleven men. Fifty-nine patients had rheumatoid arthritis and five had osteoarthritis. The duration of follow-up of the seventy-five knees ranged from twenty-four to sixty-eight months, with a mean of thirty-nine months.

The indication for operation was pain, except for one knee which had undergone ankylosis after a double osteotomy and anterior synovectomy. In addition, thirty-seven knees demonstrated significant collateral deformity or instability: fifteen knees were in valgus, thirteen in varus and nine had gross instability. Forty-five knees had a fixed flexion deformity between 5 and 45 degrees. Patients with a flexion deformity of 30 degrees or more were admitted to hospital for serial splintage to correct the deformity as far as possible before operation.

THE OPERATION

The standard ICLH prosthesis was inserted on each occasion. A parapatellar incision, with reflection of the extensor apparatus laterally, was used to expose the joint and the routine technique was followed. A pneumatic tourniquet was used except in patients with peripheral vascular disease. The bone ends were fashioned with a reciprocating saw and the components were fixed with acrylic cement. Suction drainage was routinely used and prophylactic systemic antibiotics were given to every patient for two weeks after operation.

The knee was immobilised in a well-padded plaster cylinder for five days before active mobilisation in bed. The patient was allowed to walk after the wound had healed and when adequate quadriceps control had been achieved.

RESULTS

For the purpose of comparison with the previous analysis of Walldius arthroplasties (Phillips and Taylor 1975), the same simple criteria of success were used: a happy patient with minimal pain or none; a stable joint with corrected deformity; at least 60 degrees of flexion; and absence of any continuing major complication. The results are summarised in Table I. Fifteen of the seventy-five arthroplasties were classified as failures (20 per cent); the considerably greater failure rate in the six deceased patients was included in the total assessment to avoid bias.

The successful arthroplasties. There were sixty successful arthroplasties in this series: thirty-three knees were completely free of pain; twenty-seven had slight pain which was not disabling and in itself did not require
analgesics. In twenty of these twenty-seven knees the patients' discomfort was localised to the patellar region when walking; the remaining seven gave generalised discomfort during long walks or after prolonged standing. The range of flexion achieved in the sixty successful arthroplasties varied between 60 and 130 degrees; thirty-two had a range of 90 degrees of flexion or more, and the mean range was 91 degrees. All the successful arthroplasties had less than 10 degrees of measurable collateral rock and were also subjectively stable.

Two patients had complications which required further operations. One developed painful locking on extension, and fifteen months after arthroplasty the knee was explored; the components of the prosthesis were found to be secure, but there was patellar impingement on the upper margin of the femoral component; a patelloplasty was performed and the knee now satisfies all five criteria for success. The other patient sustained a rupture of the patellar ligament twelve months after operation; there has been a successful outcome to surgical repair.

The failed arthroplasties. Table II summarises the fifteen failed arthroplasties.

Major primary sepsis did not occur in this series. One patient developed septicemia and septic polyarthritis one year after operation, which did not seem to affect the arthroplasty, but the knee became inflamed when the antibiotics were stopped and the same phage-type staphylococcus was isolated from the arthroplasty; the infection was cleared by local irrigation and antibiotics, but the arthroplasty became painful and unstable.

Major loosening occurred in three arthroplasties. In the first, a cortical fracture of the tibial plateau occurred at the time of operation, the knee remained painful and over the next five months the tibial component tilted into varus; this component was obviously loose when explored; a compression arthrodesis was attempted, but a fibrous union resulted. Delayed loosening occurred in two patients. In one of these, at exploration two years after the original operation, there was marked tissue reaction to loose cement debris, with pitting of the tibial component; there was no evidence of infection; compression arthrodesis has twice been attempted, but a fibrous union has ensued. In the other, loosening occurred thirty-five months after operation; a Walldius prosthesis was inserted at revision and has been satisfactory.

Four arthroplasties failed on pain alone. In three the pain was patellar in origin, namely after walking or prolonged sitting, and analgesics were required. One patient had an active synovitis in other joints, and it is probable there was a similar synovitis around the replaced joint.

Three arthroplasties had painful collateral instability of more than 10 degrees. In one patient there had been a 30-degree instability which at operation appeared to have been corrected; after one year increasing instability had been noted, but she refused further treatment. The other two arthroplasties were in a patient with bilateral replacements: on weight-bearing, she has 10 degrees of varus deformity in one knee and 20 degrees of valgus in the other; further correction may be required, but she considers her present condition an improvement on her state before operation and is reluctant to have another.

Two patients' arthroplasties failed solely because of inadequate flexion. In one of these the knee had been immobilised for three weeks after operation. Both patients had manipulations under anaesthesia between four and six weeks after operation, but never achieved a flexion range of 60 degrees. Both were otherwise satisfied with the outcome of the operation.

One patient was noted to have gross backward tilting of the femoral component, although he was free of symptoms and had a stable knee, twenty-six months after the operation; this was considered a failed arthroplasty. Surgical revision was planned, but he died.

Table I. Summary of results (75 arthroplasties)

<table>
<thead>
<tr>
<th>Reason for failure</th>
<th>Treatment</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Delayed sepsis (septicaemia)</td>
<td>Antibiotics plus local irrigation</td>
<td>Painful; 20 degrees instability</td>
</tr>
<tr>
<td>Major loosening of tibial component</td>
<td>Two arthrodesed. One revised to Walddius prosthesis</td>
<td>Fibrous union. Satisfactory</td>
</tr>
<tr>
<td>Pain alone</td>
<td>Analgesics</td>
<td>One improved when flare-up receded</td>
</tr>
<tr>
<td>Painful instability</td>
<td>One refused a further operation. Bilateral knee replacements</td>
<td>Remains unstable. May require further operations</td>
</tr>
<tr>
<td>Inadequate flexion</td>
<td>Manipulations under anaesthesia at six weeks and at four weeks respectively</td>
<td>Neither achieved a 60-degree range</td>
</tr>
<tr>
<td>Persisting complication</td>
<td>Gross tilting of femoral component—patient died before a further operation</td>
<td></td>
</tr>
<tr>
<td>Patient dissatisfaction</td>
<td>None</td>
<td>Movement 0–115 degrees; stable; minimal pain</td>
</tr>
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from unrelated causes before this operation could be done.

Only one patient, with an odd personality, expressed dissatisfaction with the result of the operation. On all other criteria the arthroplasty was successful.

**DISCUSSION**

One of the conclusions made by Phillips and Taylor (1975) was: "It may well be that the metal-to-plastic non-linked prosthesis will give results superior to the Walldius". In fact, the overall result of this review of ICLH Mark I knee replacements, using the same criteria, indicated a similar success rate.

The potential range of flexion in the ICLH knee replacement is greater than in the Walldius prosthesis, which could not flex beyond 90 degrees. It was previously noted that some patients experienced difficulty in rising from the seated position as a result of this limitation (Phillips and Taylor 1975). In those patients with ICLH arthroplasties with flexion more than 90 degrees, however, the ability to rise from a chair was not significantly improved over those having a lesser range.

The hinged prosthesis locks in full extension and allows no rotation, thus predisposing to loosening. Forty-eight (72 per cent) of the Walldius arthroplasties were loose, but only three (3.6 per cent) gave rise to severe pain. Only three of the ICLH replacements (4 per cent) became loose but all were painful and required revision; one has been successfully replaced by a Walldius prosthesis, and in the other two arthrodesis was attempted but in both only fibrous ankylosis resulted.

Of great importance is the weight-bearing alignment of prosthetic knee joints. Body weight is transferred through the centre of a prosthetic joint in a knee correctly aligned in physiological valgus. When there is a valgus or varus deformity, the line of weight-bearing is lateral or medial to the centre of the prosthesis. In such circumstances a tilting moment is applied to the prosthetic components. Where the tibial component does not overlie the peripheral cortical bone or where this is fractured, the moment of tilt will predispose to its sinking into cancellous bone with subsequent loosening. The relationship of clinical alignment at review to the result in the present series is summarised in Table III.

**Table III. Relationship of clinical alignment and failure**

<table>
<thead>
<tr>
<th>Alignment (degrees)</th>
<th>Successes</th>
<th>Failures</th>
<th>Percentage of failure</th>
</tr>
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<tbody>
<tr>
<td>Varus 10</td>
<td>7</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Varus 5</td>
<td>17</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Valgus 5</td>
<td>31</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Valgus 10</td>
<td>15</td>
<td>1</td>
<td>16.6</td>
</tr>
<tr>
<td>Valgus 15</td>
<td>20</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Totals</td>
<td>60</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

and bears out the theory that knees in 5 degrees of valgus are the most successful. On the other hand, all three knees that loosened began with a 5-degree varus alignment. The seven still-successful arthroplasties with 5 degrees of varus alignment have, after being initially painless, developed slight pain and show evidence of early collateral instability. Although none of these knees has so far demonstrated clinical or radiological evidence of loosening, we feel they are "at risk".
The advantages of a hinged prosthesis are that it can be self-aligning and inherently stable. In the non-linked prosthesis correct alignment and stability depend on the accurate positioning of the components and the integrity of the collateral ligaments. To achieve such a situation the tibial component must be placed perpendicular to the tibia in both the sagittal and coronal planes; by fixing the femoral component between 5 and 10 degrees of valgus to the sagittal plane of the shaft of the femur, the desired alignment in valgus will be secured. In addition to correct positioning of the components, the tension of the collateral ligaments must be maintained and not prejudiced by sacrifice of bone for the correction of the deformity; this should be by soft tissue release. Figures 1 and 2 show a correctly set prosthesis.

The overall results of the present series would seem to indicate that there is little to choose between the hinged knee prosthesis of Walldius and the non-linked prosthesis of Freeman and Swanson. A proportion of the successful Freeman–Swanson arthroplasties were, however, of a degree of excellence not seen in the Walldius series; twenty (33 per cent) gave no pain at all, were completely stable and with a range of active flexion of more than 90 degrees. These patients were entirely satisfied. It is noteworthy that all of these arthroplasties were aligned within the variance of 5 to 10 degrees of valgus.

Instrumentation introduced since this series facilitates correct alignment and tension of the ligaments. The prosthesis has been modified to give greater stability to the tibial component and, in the femoral component, to provide a higher and congruous articulation with the patella. These improvements encourage the belief that fewer failures and a higher proportion of excellent results can be achieved from this operation.

REFERENCES