ASSESSMENT OF THE DENHAM KNEE REPLACEMENT

RESULTS AFTER EIGHT YEARS

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The Denham knee replacement is a relatively simple unconstrained prosthesis. The design ensures good alignment and full extension, but does not allow flexion beyond 90° or tibiofemoral rotation. The results after eight years' experience have been assessed in four different ways in over 600 cases. They show that for the limited needs of the elderly arthritic patient, the Denham arthroplasty provides a high proportion of satisfactory results with an unusually low rate of late failure.

The Denham knee replacement was designed in the light of work on the basic mechanics of the knee (Denham and Bishop 1978) and experience with other prostheses, especially with the Freeman-Swanson ICLH pattern. The aim was to produce a simple, easily inserted, unconstrained arthroplasty which would meet the limited needs of the elderly arthritic patient. Emphasis was placed on obtaining the correct 7° valgus alignment of tibia and femur in the coronal plane. This was ensured by intramedullary splines, one of which formed a permanent part of the femoral component while the other was removed from the tibia once the bone cement had set. The design and the method of insertion also provided for accurate limitation of full extension by normal biological tension in the posterior capsule and ligaments.

The articulating surfaces are matching parts of a regular cylinder with an area adequate to eliminate excess wear, a radius small enough to provide anteroposterior stability and as wide as the upper tibia to give a broad bearing surface in the coronal plane (Figs 1 and 2). This last feature, together with the built-in accuracy of valgus alignment, ensures that the forces of weight-bearing pass through the central third of the prosthesis (Fig. 3). This greatly reduces the lateral pressures which have been shown, experimentally and clinically, to lead to tilt, over-pressure and failure (Gibbs, Green and Taylor 1979; Bargren, Blaha and Freeman 1983).

The first Denham prostheses were inserted in 1976; since then only minor changes have been made, usually

to improve the accuracy of alignment. Over 350 have been carried out by the originator at Portsmouth, while 300 of those done at other centres have also been reviewed. The early results were encouraging and there have been few late failures. Flexion is limited to 90° by the design, but this, after pre-operative explanation has proved acceptable to most patients.

The period of follow-up regarded as acceptable for worthwhile reporting is increasing, and few single

Fig. 1

Fig. 2

The prosthesis viewed from the front and from the side. The cylindrical stem of the femoral component is inclined at 7° to the vertical. Note the shallow cylindrical bearing surface of the tibial component and the polyethylene screw used to plug the hole through which passes the temporary aligning rod.

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centres can provide enough replacements to offer valid direct comparisons. A number of authors have addressed themselves to this problem (Freeman, Todd and Cundy 1977; Hungerford and Kenna 1983; Waugh 1983; Tew 1984). Assessment of the Denham arthroplasty was therefore planned, not only from the continuing computer-assisted follow-up being conducted by the originator, but also by independent review of three overlapping series of cases. The aims were to improve the breadth and the accuracy of the report, to facilitate comparison of results with those of other series, and to allow study of the methods of assessment themselves.

First, traditional clinical review of 90 randomly selected patients with 112 knee replacements was carried out in detail at a mean follow-up of 54 months. Secondly, the records of all 335 Portsmouth patients were used to construct survivorship tables in the manner of Tew and Waugh (1982) and to calculate annual and cumulative rates of failure and success. Finally, to assess whether the operation would succeed away from the special expertise and enthusiasm of the originator and his unit, 307 patients from six other centres were reviewed and reported retrospectively in the same format as the continuing Portsmouth study.

METHODS AND MATERIAL

Technique of operation

The operation has been described in detail by Denham (1984). A high thigh tourniquet is applied without exsanguination. In the absence of the scars of any previous operation, a long straight anterior skin incision is used. This gives access for a medial parapatellar approach, which is extended to mid-thigh by splitting the quadriceps tendon.

The patella is then displaced and turned laterally, and the medullary cavity of the femur is broached through the lower end of the femur to allow the introduction of a long intramedullary rod, which carries a template. This template is at 7° valgus to the transverse plane of the femoral shaft and its rotation is set by reference to the plane of the femoral condyles. The lower femur is prepared by three saw cuts, leaving a rectangular, accurately inclined distal surface.

The plateau of the tibia is prepared, aligned at 90° to the shaft of the bone by a temporary intramedullary rod. Posterior capsular and ligamentous structures are preserved and the minimal thickness of bone excised, special thickened prostheses being available to compensate for excessive bone loss on either medial or lateral side. These prostheses automatically provide the few degrees of overcorrection which are needed in these cases.

When the tibial component has been securely cemented and the temporary intramedullary rod removed, final fittings are made of the femoral prosthesis, relying on its thick intramedullary spline to align the

joint surface in 7° valgus. When there has been significant varus or valgus deformity before operation, the contracted collateral ligament on the concave side of the joint may require division to allow comfortable apposition of the joint surfaces in full extension; further parallel shortening of the femur may be needed to attain this position.

Fig. 3
Anteroposterior radiograph to show the line of weight-bearing passing through the central one-third of the prosthesis.

Finally, the definitive femoral prosthesis is pressed into a bed of hardening methylmethacrylate cement by the nutcracker action of extending the knee fully against the tension of posterior capsule and ligaments – thus ensuring that there will be biological limitation to prevent overextension. While this is done the valgus alignment of the femur and tibia is ensured by the splined prosthesis.

After operation antibiotic cover is continued for five days. The knee is splinted straight and not actively flexed until the wound has healed soundly. Physiotherapy then helps to secure a progressive, controlled increase in flexion, 90° usually being achieved by 10 weeks.

Assessment of results

Since the first arthroplasty in 1976 every effort has been made to follow progress on a regular basis. After six months, one year, two years and at two-yearly intervals

thereafter, detailed records of symptoms and findings on examination have been recorded, together with the results of radiography including carefully aligned full-length, weight-bearing films (Denham 1984). All this information has been held in the Wessex computer. Results based on a numerical assessment of five features have been available from the computer. Follow-up has been good: excluding deaths, only 13 of the possible 150 patients failed to attend their four-year review.

Independently of this continuing internal review, the Denham knee replacement was assessed clinically, by survivorship studies and in an "other centres" review. **Clinical review.** The aim was to review 100 patients randomly selected by year of birth from the 320 who had Denham knee replacements between 1976 and 1982 at Queen Alexandra Hospital, Portsmouth, or Lord Mayor Treloar Hospital, Alton. In fact 90 of 127 selected patients were reviewed in detail at special clinics by one of us (CRT), allowing study of 112 knee replacements. Of the 37 patients randomly selected but failing to attend for review, 23 had died from causes unrelated to the operation and eight had moved from the district; four were unfit to travel to the clinic, and two refused to attend.

Each patient was asked for an opinion of the result which was recorded as enthusiastic, satisfied, non-committal or disappointed. A standard clinical and radiological review was completed and information was recorded on a form simplified from that of Aichroth et al. (1978). Previous operations on the affected knee were recorded, as were details of the clinical state of the other knee, hips and ankles. Information on postoperative complications and difficulties was obtained from the patients and from perusal of the case notes.

The present state of the arthroplasty was assessed in terms of pain and function. Pain was regarded by the reviewer and the patients as by far the most important feature of the result. It was graded thus: none; mild, not interfering with activities or sleep; moderate and intermittent; or severe and constant. The walking distance, the need for a walking aid and the ease or difficulty of rising from a chair were also noted.

Clinical examination included observation as to whether the knee moved normally or was stiff during walking. Knee flexion was measured and deformity or extension lag noted, and the degree of collateral stability was determined.

All patients had had long-leg, weight-bearing radiographs before operation and in the early recovery period. Unless a recent film was available a new radiograph was taken for this review, using a technique designed to minimise error due to fixed flexion or a rotated position (Denham 1984). On each film the tibiofemoral angle in the coronal plane was measured and recorded as "degrees of error" – that is, the difference from 7° of valgus which was taken as normal (Denham and Bishop 1978). Any radiolucency near

components, or fracture or displacement of the barium-loaded cement, was noted.

The results of this independent assessment were afterwards compared with those recorded on the Portsmouth computer cards which were used for routine annual or biennial review. Differences were minor and usually resulted from differing interpretations of the comments of patients. The computer results had been classified as excellent, good, fair or poor on a points system which gave 0 to 5 for each of five factors: patient's opinion, surgeon's opinion, pain, movement and function (Denham 1984). In the clinical review it became clear that the pain level and the patient's satisfaction were closely linked and together formed the best simple criterion for success. On this basis, an *excellent* result was one in which an enthusiastic patient was free of pain, while a *good* result was recorded for mild pain in a satisfied patient. *Fair* meant satisfaction with the overall result despite more than mild intermittent pain or flexion of less than 60°. A result worse than this in any respect or with flexion of less than 50° was recorded as *poor*.

Survivorship study. The routine follow-up cards and where necessary the hospital records and radiographs for all Denham knee replacements by, or under the direct supervision of, the originator were perused. Survivorship tables were completed on the principles developed by Armitage (1971, pp 408-14), Dobbs (1980) and Tew and Waugh (1982). Note was made of the date of the latest review in relation to the date of operation and of the state of the arthroplasty, with particular reference to whether the original prosthesis was still in situ and whether the result of the operation could be considered satisfactory.

The definition of satisfactory, upon which the relevance of the second assessment depends, is a difficulty which attends any such review. With the aim of simplicity, cases were regarded as failures if pain in any way approached that suffered before operation or if stiffness or deformity was unacceptable to the patient. Death within three months of operation has, in conformity with previous studies, not been recorded as a failure of the prosthesis. Later deaths, unconnected with the operation, are inevitable but we feel that they and the failures of follow-up should be recorded separately for each annual period after arthroplasty. This complicates the table only a little and avoids grouping them as "withdrawals" or as "successes", which has been a little misleading in some previous reports.

Failure due to infection, leading either to removal of the prosthesis or to pain and stiffness, has been recorded as failure in this as in other studies, even though it may not be related to the type of prosthesis. Painful aseptic loosening occurred only four times in the series. These were recorded as failures, in each case followed by successful revision; the newly inserted prosthesis was regarded as a fresh arthroplasty for continued follow-up.

Other centres. Thanks to the hard work of a number of

Table 1. The relation between pain, the degree of flexion obtained and the patient's satisfaction

Reaction of patient	Pain			Flexion			Total	Per cent
	None	Mild	Moderate*	80° or over	60-79°	Under 60°		
Enthusiastic	61	14	1	69	6	1	76	68
Satisfied	15	10	4	15	5	9	29	26
Non-committal	1	0	0	1	0	0	1	1
Disappointed	0	5	1	5	1	0	6	5
Total	77	29	6	90	12	10	112	100
Per cent	69	26	5	80†	11	9		

* No patient had severe pain

† 68% of all patients had flexion of 90° or more

consultants and senior registrars, standard review cards of 307 patients who had had a Denham knee replacement were completed and returned to Portsmouth. These were all the patients treated at six of the other centres which are routinely using this arthroplasty. Results obtained from notes and at some centres from personal reviews were analysed and recorded in the Wessex computer to facilitate comparisons. Information was not complete enough to add to the clinical or the survivorship studies, but proved to be even more useful than expected for the general assessment and future development of the arthroplasty.

RESULTS

The clinical review

One hundred and twelve knees were reviewed in 90 patients comprising 70 women of average age 70.2 years (range 25 to 85 years) and 20 men of average age 65.5 years (range 55 to 86 years). Sixty-five knees were affected by rheumatoid arthritis, and 47 by osteoarthritis. Both knees were replaced in 11 patients, and of the remainder approximately equal numbers of left and right knees were replaced. Follow-up was from 2 to 7.5 years with a mean of 4.3 years. Of the 37 patients randomly selected but not reviewed for the reasons given above, 30 were recorded as having had good or excellent results at their latest routine review.

Previous surgery. Tibial osteotomy had been performed in four knees. This may make insertion and correct alignment of the tibial component rather difficult and was responsible for one poor result. Four knees had revision of an earlier joint replacement, in three a loose ICLH prosthesis and in one a loose Walldius prosthesis. Three of these had excellent results at 7, 3.5 and 3 years; one was fair after 2 years, being pain-free but with limited flexion.

Complications after operation. Complications were usually mild and reversible, the most common being the delay in wound healing seen in 12 knees, 10 in rheumatoid patients. Of the selected 127 patients, 21 (16.5%) had various minor complications but there had been no mortality within six months of operation.

Pain. Effective relief from pain was achieved in 95% of knees, 69% reporting complete absence of pain and 26% mild pain which did not interfere with activities or sleep. It was clear that in the patient's opinion pain relief was the most important feature of the operation. Table 1 shows that of 22 patients who obtained less than 80° of flexion only one was less than satisfied with the result, whereas six of 35 patients with mild or moderate pain were disappointed. Moderate retropatellar pain, enough to interfere with sleep, was reported of one knee giving a poor result. Mild intermittent anterior discomfort occurred in nine knees (8%) but had resolved in most cases by one year after operation.

Knee function. Walking distance is often not a good indicator of the success of knee replacement because arthritis of other lower limb joints is common. Nevertheless, half of the reviewed patients were able to walk more than half a mile (0.8 km) while three-quarters of them used either no walking aid or a single stick for added security when out of doors. Just under half the patients could rise from an upright chair with ease, the remainder needing to use their arms to push themselves up; one-tenth had difficulty. The gait included a normal-looking knee swing in 85% though much affected by age and other joint disease.

Knee flexion. Flexion was over 80° in 80% of patients (Fig. 4). The range of flexion did not appear to rate as

Fig. 4

Distribution of the range of knee flexion in the clinical review.

Table II. Annual rate of removal of prosthesis and the cumulative retention rate in 335 Denham knee replacements

Years since operation A	Number at start B	Results at latest review				Number at risk G	Annual removal (per cent) H	Cumulative retention (per cent) J
		Lost to follow-up C	Died D	Prosthesis still in E	Prosthesis taken out F			
0 1	335	1	7*	45	2	308.5	0.6	99.4
>1 2	280	0	1	53	1	253	0.4	99.0
>2 3	225	4	7	62†	1	188.5	0.5	98.5
>3 4	151	5	9	23	3	132.5	2.3	96.2
>4 5	111	4	9	43†	1	83	1.2	95.1
>5 6	54	2	1	19	0	43	0	↓
>6 7	32	0	1	19	0	22	0	
>7 8	12	3	1	7	0	6.5	0	
>8 9	1	0	0	1	0	0.5	0	

* All 7 before six months, 4 before three months were probably attributable to the operation

† Larger numbers in even years because of biennial follow-up

Notes. Each knee is entered once in columns C, D, E, or F according to the period from operation to the latest review and the state recorded at that review

In any one year $G = B - \frac{C + D + E}{2}$; $H = \frac{F}{G} \times 100$

Cumulating in successive years $J_1 = 100 - H_1$; $J_2 = J_1 - H_2$; $J_3 = J_2 - H_3$ etc.

Table III. Annual rate of incidence of unsatisfactory results * and cumulative remaining satisfactory results in 335 Denham knee replacements

Years since satisfactory operation A	Number at start B	Results at latest review				Number at risk G	Annual unsatisfactory (per cent) H	Cumulative satisfactory (per cent) J
		Lost to follow-up C	Died D	Satisfactory E	Unsatisfactory F			
0 1	335	1	7	43	4	309.5	1.3	98.7
>1 2	280	0	1	50	4	254.5	1.6	97.1
>2 3	225	4	7	58	5	190.5	2.7	94.6
>3 4	151	5	9	20	6	141	4.6	90.3
>4 5	111	4	9	43	1	83	1.2	89.3
>5 6	54	2	1	18	1	43.5	2.3	87.2
>6 7	32	0	1	19	0	22	0	↓
>7 8	12	3	1	7	0	6.5	0	
>8 9	1	0	0	1	0	0.5	0	

* Unsatisfactory results are those with removal of the prosthesis, significant pain or unacceptable stiffness
Other derivations are similar to those given in Table II

highly with patients as did relief of pain; 10 knees flexed less than 60° although still associated with enthusiastic or satisfied responses (Table I). Five knees had flexion of 50° or less and were accordingly recorded as having poor results, though this limitation was often compatible with acceptable function – and if painless was rarely a source of complaint. Three knees showed flexion contractures of 10° or more.

Coronal alignment. Correction to within 5° of the norm (2° to 12° valgus) was achieved in 95% of those knees which had been valgus before replacement, and in 86% of those which had been varus. Overall, 90% were in acceptable alignment at review. Comparison of the tibiofemoral angle in the first postoperative film with that taken at this review after a mean period of 52 months showed improvement in none and significant deterioration (over 5°) in only one – the case in which an earlier tibial osteotomy had led to difficulty and poor original alignment of the prosthesis.

Radiolucency. A thin radiolucent line was noted between the bone and the barium-loaded cement about the tibial component in 14 knees (12.5%). This line was 1 mm or less in width in all cases and did not appear to progress. It was almost invariably present in radiographs taken one year after operation and was not associated with pain.

of cases which will not be considered again. These are: late deaths, a significant number in the aged population at risk and usually unrelated to operation; cases lost to follow-up for any reason (which could include a revision operation at another centre); and those who have not yet reached the next time interval for review.

These figures have been included separately since they indicate the early and late mortality of the series and also the proportionate loss from follow-up – figures relevant for comparison with other reports.

Retention of the prosthesis. At the time of review four prostheses had been removed as a result of sepsis: all four patients had had a satisfactory arthrodesis after external bar fixation (Wade and Denham 1984). Three painful loosening had been revised, using special tibial components, and one leg had been amputated after loosening below a previously arthrodesed hip.

This gave an annual rate for removal of the prostheses varying from 0.6% and 0.4% in the first two years to 2.3% in the fourth year. Cumulative figures show that 95% of prostheses are retained at five years, a figure considerably higher than those reported in other series (Table IV), being much the same as that reported by Dobbs (1980) for early Stanmore metal-on-plastic hip replacements.

Table IV. Results of survivorship studies, published 1980 to 1986

Author	Joint	Prosthesis	Cumulative success at 5 years (per cent)		
			Prosthesis in situ	Prosthesis in situ, no severe pain	Satisfactory
Dobbs (1980)	Hip	Metal-on-metal	75.5	—	—
	Hip	Metal-on-plastic	94.9	—	—
Tew and Waugh (1982)	Knee	Various	78	—	—
Grimer, Karpinski and Edwards (1984)	Knee	Stanmore	85	77	69
Letting <i>et al.</i> (1984)	Knee	Stanmore	87	82	—
Thacker and Fulford (1986)	Knee	Denham	95	—	87

Survivorship study

The analyses in 335 consecutive Denham arthroplasties are presented in Tables II and III. These are constructed in the manner of previous similar reports with the additional breakdown of withdrawals mentioned above. Table II uses retention of the prosthesis as the sole measure of success; unfortunately this permits a grossly dissatisfied patient to be classified as a success. Table III uses two criteria for success: retention of the prosthesis and a satisfied patient (satisfaction implies little pain and reasonable movement).

For each additional year of follow-up it is obvious that fewer cases will be available for consideration. Apart from those leaving as “failures” at any given stage (Column F in each table) there are three other categories

Satisfactory result. These figures are equally encouraging. There were 87% cumulative “satisfactory” results at five years. Perhaps as important, there was no pattern of increasing rate of failure with time as had seemed to be a possibility from some of the figures reported by Tew and Waugh.

Other centres

Colleagues from London, Northampton, Black Notley, Worthing, Chester and Glasgow reported the results of 307 arthroplasties. Follow-up was between two and four years in four of the centres but only one year in the other two, with an overall average follow-up of two and a half years. At the London Hospital, patellar pain associated with subluxation of the patella was a problem in 12% of

their patients. Lateral subluxation of the patella on knee flexion was also reported in two cases from Northampton, and in a third case the patella was found to be permanently dislocated; at this centre one patella was resurfaced, and manipulation under anaesthesia was used occasionally for delay in return of knee flexion. In Chester, manipulation of the knee was performed three to four weeks after replacement in nearly half the cases. Delay in regaining movement was also noted in many cases in Glasgow, but prolonged physiotherapy was the preferred method of management. Cement containing gentamicin was used routinely at Black Notley Hospital and no significant sepsis was reported. The results reported from Worthing were those most comparable with the Portsmouth series, perhaps because the surgeon had extensive experience with the prosthesis while working with the originator. In all, about 80% of replacements in the six centres were satisfactory at a mean follow-up of two and a half years and no centre had abandoned the operation for another arthroplasty. The results were less dramatically successful than those from Portsmouth and there were more complications. In particular, the problem of patellar subluxation at some centres required investigation; this is discussed later.

DISCUSSION

Assessment of knee arthroplasty

An objective evaluation of one type of knee replacement is difficult even when it can be compared with other types used in the same centre. The long period of follow-up necessary means that the reporting of an unchanged technique is rare, and that reports comparing consecutive series using different implants may be less valid because of changing methods.

To assess an arthroplasty in isolation is even more difficult because there are no widely agreed methods of scoring results – and all must depend to some extent on subjective judgements. A knee replacement is more likely than a hip arthroplasty to be performed for a patient with multiple joint involvement and this makes any assessment of general function and of gait in relation to a single joint a much less reliable and repeatable exercise. Standard hip scoring systems such as those of Larson (1963) and Merle d'Aubigné (1952) include these estimates and give about a third of the total points for pain. The Wessex computer scoring for the Denham review allocates only one-fifth of the score for pain, though, as we have shown, the fifth of the score for patient satisfaction is likely to be strongly influenced by comfort.

The contribution made by the life table or survivorship method developed by Tew and Waugh (1982) has been considerable, giving the ability to rate results on any given criterion related to time since operation. This has allowed a more objective comparison of the chances of continued success of an arthroplasty. But even the

apparently simple criterion of retention of the prosthesis can be biased – for example, by greater willingness to revise (and then to record as a failure) those less invasive prostheses which are technically easy to replace by another type of joint. The use of other criteria such as "pain in the knee", "onset of serious complications" (Grimer et al. 1984) or even "dissatisfied patient" introduce the variables which bedevil assessment.

The urgent need is still for an acceptable objective scoring system or for extreme simplicity of criteria. One of our patients highlighted this. Her completely painless result, with full extension and a good swinging gait had to be recorded as a failure because she was dissatisfied with flexion of 80°.

The reports from other centres proved valuable in several ways. It is a truism that the originator of a procedure will obtain better results because of his enthusiasm and the ever-present "gratitude factor". Any other surgeon, using a new and unfamiliar prosthesis, cannot be expected to avoid learning curves of patient selection and operative technique. However, despite a failure rate over double that of the "home" series, all six centres professed themselves satisfied with their results; but there were notable, even dramatic differences between the series.

Three examples of this variation will indicate the value of this part of the assessment. First, at some centres a 10 times greater frequency of manipulation under anaesthesia reflected either impatience with a procedure designed to give limited flexion rather slowly, or perhaps less spirited encouragement and physiotherapy.

Secondly, section of a collateral ligament was needed to obtain good alignment and movement on the operating table in about a quarter of the Portsmouth cases; this produced no problems of lateral instability and was often the only possible way of securing good stable alignment. However, despite clear instruction, five of the six centres reported no case in which collateral release had been done.

The third example is the incidence of patellar pain, lateral subluxation or frank dislocation in 12% of patients at one centre. The Portsmouth series has been notably free from serious patellofemoral problems. This difference is being investigated but seems to be due to an error in the advised rotational alignment of the femoral component. It seems probable that for a knee with a pre-operative valgus deformity the Denham femoral component should be aligned in rotation parallel to the posterior and not to the anterior margins of the femoral condyles.

The use of several modes of assessment proved helpful and instructive. It became clear that valid comparison of knee replacements of different types would require multicentre agreement on objective scoring systems with a prospective follow-up of adequate numbers. In this way it could be possible to discern early trends and make worthwhile changes in technique and equipment on a statistical, scientific basis.

The Denham knee replacement

In general the results have compared well with those reported for other series (Table IV). The original design aimed to relieve pain and deformity and provide the limited function needed to give acceptable mobility to the elderly arthritic patient. The lack of rotation and the limitation of flexion were intended to simplify the prosthesis and the procedure. These restrictions may have also been responsible for the relative absence of patellofemoral problems in the main series and the lack of need for patellar resurfacing.

The importance of accurate rotational alignment of the prosthesis in the absence of medial tibial rotation during flexion has been discussed above and has been emphasised by the "other centre" study.

The emphasis on correct in-built alignment would appear to have helped to achieve a very low rate of late failure, and the only modifications in eight years have been to improve this alignment with a range of three tibial prostheses which provide a fine adjustment. The intramedullary extension of the operation has produced no problems and despite some misgivings (Waugh 1983) has provided accuracy of alignment comparable with that reported from the use of complex external jigs. It may be that part of the continued acceptability of the constrained hinge (Lettin et al. 1984) is due to in-built alignment, while the rate of aseptic loosening (8.1% in Lettin's series, under 2% in the Portsmouth series) is a reflection of mechanical as against biological constraint (Murray 1980).

The main problem produced by lack of flexion has been that of rising from a chair. This must give difficulty when the patient cannot easily place her centre of gravity above her feet, but only 2% had serious reservations and many accepted the need for assistance or special chairs. It is important that these limitations are understood by the patient before operation. Pain relief, with half flexion and half function is normally an acceptable compromise.

The Denham arthroplasty has, in our opinion, been shown to be capable of providing a replacement knee which is adequate for the normal purposes of the elderly arthritic patient, is technically not too exacting and has better prospects of longevity than most alternatives.

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