Results of Open Arthrolysis for the Treatment of Arthrofibrosis Following Uncemented Total Knee Arthroplasty

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Abstract

Arthrofibrosis is an uncommon but potentially debilitating complication following TKR. The treatment of this condition remains difficult and controversial.

1522 patients undergoing primary uncemented TKR have been included in this study (2022 TKR's). 13 patients underwent open Arthrolysis for stiffness post-op (Incidence 0.64%).6 patients received simultaneous bilateral procedures (Incidence 1.2% of bilateral procedures).

The average time between TKR and arthrolysis was 14 months. Our average follow-op was 7.2 years (range 2 – 10 years)

The mean ROM prior to Arthrolysis was 58°.The mean ROM six months after surgery was 91° ($p<0.005$). The average ROM at last follow-up was 96° ($p<0.005$) with an average Knee Society score of 155 (pain 83, function 72).

No patients have required revision of their components.

We have found arthrolysis to be a useful and successful approach to post- TKR stiffness. Range of movement is improved by six months and is maintained for up to 10 years.

Introduction

Stiffness after a total knee replacement (TKR) will occur in approximately 1% of patients (1). A fixed flexion deformity increases the quadriceps effort required in walking and increases load at the patella-femoral joint. For activities of daily living, the knee needs to be able to flex to 65 degrees to walk along a level surface, 85 degrees to negotiate a six-inch step and 95 degrees to rise from a chair easily (2).

The causes of stiffness are numerous and multifactorial. They include infection, component mal-position and over sizing, poor ligament balancing, inadequate osteophyte removal, loosening and reflex sympathetic dystrophy. Most cases will resolve with structured physical therapy. Manipulation under anaesthetic has been helpful in early cases (3-6). Once the scar tissue has matured the best approach to treating this problem remains controversial with increasing support for revision arthroplasty (1,7). Our approach to this problem is an extensive open arthrolysis with selective polyethylene downsizing and/or patella replacement as required. We report on our results.

Materials and Methods

Since August 1992 the senior author has used the Active uncemented Total Knee Replacement (ASDM, Australia) in all primary TKR's. This is a hydroxyapatite-coated, uncemented, PCL retaining design with a cemented polyethylene patella button. This single surgeon series has been prospectively followed up with the Knee Society Scores (KSS) (9), range of movement and complications. The total number in the cohort is 1522 patients with 2022 knee replacements in total. Of these, 500 patients underwent a simultaneous bilateral procedure.

From this cohort, 13 (0.64%) patients had significant arthrofibrosis that was severe enough to warrant an open arthrolysis for persistent stiffness (5 male and 8 female). The mean age was 65 years at the time of the primary TKR (range 50-78 years). Six of the 13 patients had undergone simultaneous bilateral TKR (1.2% of the bilateral group). 2 of the 13 knees had a patella replacement at the time of primary surgery. There were no cases of

infection (based on microbiological culture) and no cases of component malposition. No patient underwent MUA or other surgical procedure prior to the arthrolysis.

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS, version 10.0, Chicago, Illinois). The range of movement pre and post arthrolysis and the KSS were analysed using a paired t-test. A Wilcoxon signed-rank test was used to analyse the KSS scores and movement arcs assuming non-parametric data. Significance was assumed if $p<0.05$.

Surgical Technique

All patients underwent an open soft tissue arthrolysis. The procedure is performed with a tourniquet. The original scar is re-opened and the incision deepened to the capsule. The knee is opened medially and the thickened capsule excised from the joint. This capsular scar tissue can be as much as 15mm thick. Adhesions under the supra-patella pouch are released. The scar tissue is removed from the medial gutter. A lateral release is then performed to free the extensor mechanism and clear the scar tissue from the lateral gutter. This allows access to the tissue under the patella tendon.

We feel that by approaching the tendon from this side the tissue planes are easier to define as this is relatively virgin tissue. The scar tissue behind the patella tendon can then be released. This scar tissue tethers the patella tendon causing patella infera, often seen in these knees. Patella height must be recovered to maximize recovery. After this release, we have found the patella can then be everted without the need for a quadriceps snip, turn

down, or tibial tuberosity osteotomy. The knee can then be flexed to allow access to the posterior structures. The PCL was released in all cases. The posterior structures are examined and the popliteus tendon, and/or posterior capsule may require release to correct the fixed flexion deformity. Removal of a modular tibial insert facilitates access. Downsizing the polyethylene can help with the correction. This was done in 3 cases. These inserts were downsized from 11.5mm to 10mm in all cases (10mm is the thinnest insert/baseplate option in the Active knee system).

Patella tracking is then assessed and the patella was resurfaced if there was any concern about patello-femoral pressure. This occurred in 5 patients. The knees were all drained and closed in flexion. Continual passive motion (CPM) was started on the day of operation and rehabilitation was commenced under the direction of a physiotherapist. Post-op analgesia was supervised by the attending anaesthetist's preference.

Results

There was no difference between the pre-op demographics of the arthrolysis subgroup and the total series (Table 1). The pre-TKR knee score was a mean of 103 out of 200. The group had a mean flexion of 110 degrees (range 80-130 degrees) with a mean fixed flexion deformity (FFD) of 8 degrees (range 0-20 degrees). The average time from TKR to arthrolysis was 14 months (range 6-21 months). The mean time to most recent follow-up is 7.2 years (range 2-10 years) from primary TKR, with 6 patients followed up for 10 years.

Three patients had complications. One patient required a repeat arthrolysis for stiffness 2-years following the initial release. One knee became infected 6-years after implantation following septicaemia caused by a spider bite. This was treated with arthroscopic synovectomy and IV antibiotics. At 10 years the TKR was still in situ. There was one death at 7-years due to leukaemia.

Range of movement data is presented in Table 2. Prior to arthrolysis the mean arc of movement was 58 degrees with a mean fixed flexion deformity of 10 degrees. Range of movement was recorded in all patients at 6 months post arthrolysis with flexion values increasing to a mean of 91 degrees (range 58 – 110 degrees), a mean improvement of 33 degrees movement ($p<0.005$). At the last follow-up the improvement in ROM had been maintained with a mean of 96 degrees with only one patient with a FFD of 5 degrees (flexion range 75- 115 degrees), a sustained improvement of 38 degrees over a mean of 7.2 years ($p<0.005$).

The KSS had significantly improved from the pre-TKR mean of 103 to 147 at follow up prior to open arthrolysis ($p<0.005$). The mean Clinical score was 78/100 (range 59-89) and the mean Functional score was 69/100 (range 50-90) (Table 3). Despite the limitations imposed by the stiffness of the knee there was still a significant improvement in the total KSS following TKR. At final follow up following open arthrolysis there was no significant change in the Knee Society scores. The FFD had been corrected in all but one case (one patient had a 5 degree FFD). The mean KSS was 155 out of 200 (range 118–195) at a mean 7.4 years follow-up. This is further broken down into a mean Clinical

score of 83 out of 100 (range 60-98) and a mean Function score of 72 out of 100 (range 45-100). Despite the significant improvement in ROM we were unable to demonstrate an improvement in the KSS by performing the arthrolysis.

Discussion

Stiffness following TKR is a complication that will occur in all knee surgeons' practice. The incidence appears to be low in published series at around 1% (1). There is still debate as to the definition, cause and treatment of these patients. Stiffness has been defined in various papers as being flexion of <85 degrees (10), an arc of movement of <70 degrees (11), a flexion contracture of >15 degrees and/or < 75 degrees of flexion, or an arc of movement of <45 degrees (8). Our cohort of patients all fell within the definition of stiffness cited by Kim et al (1) of an arc of movement < 75 degrees.

There are numerous proposed causes or contributing factors to post TKR stiffness. There are technical issues in component positioning and sizing that can cause stiffness (12). Overstuffing either the patellofemoral or tibiofemoral joint will restrict movement. Component design can also affect range of movement (3). The implant used in this series has a posterior offset to the femoral component designed to allow easier flexion and recessed trochlear groove…. The mean flexion in the total series of 2022 knees is 116°. Our arthrolysis group had a mean FFD of 10 degrees and an arc of flexion of 58 degrees. Other reports of open treatment for arthrolysis have had smaller groups with stiffer knees (mean arcs of movement 36-38 degrees) (1, 7, 13). Only 3 of our patients had flexion arcs

< 30 degrees. The implant design may be the reason for this. Pre-op ROM and patient motivation has also been implicated.

There will be however a group that develop severe stiffness despite a correctly sized and implanted prosthesis. This stiffness can be attributed to excessive scarring within the knee or arthrofibrosis (13). It has been suggested that patients may have a predisposition to this scaring and that heterotopic calcification around the knee may be associated with this (14). Interestingly in our series there were 6 patients with simultaneous bilateral TKR's who were only stiff on one side. In no case was treatment required on the other side. Ries et al (13) have investigated the pathological tissue and showed an increased density of fibrocartilaginous metaplasia within the scar tissue of the stiff knees. This has been show to be caused by mechanical compression and may indicate a possible trigger being post-op ROM rehabilitation (15). It is not clear why only a few patients trigger this excessive response.

The best treatment has yet to be identified with manipulation under anaesthetic, arthroscopic release, open arthrolysis with polyethylene exchange and revision TKR all being treatment options. Manipulation has a role in the treatment of early stiffness and an improvement in ROM is generally expected (5-6). However those patients who benefit from an early manipulation may be a different group from those who develop a true mature arthrofibrosis. Arthroscopic release has a role in early cases and in particular those patients with a patella clunk syndrome (16). We feel that the extensive resection required to release the knee joint cannot be done arthroscopically.

Open Arthrolysis has been reported in the literature has having poor results with its use not supported (7). In addition, tibial insert exchange has been questioned as a viable strategy for any revision surgery (17, 18). Increasingly there is move toward revision TKR as the treatment of choice for these patients. The published results of revision surgery do show improvement in ROM and pain scores although these improvements are reported as modest (1, 13). Our experience with these patients has been different. To the best of our knowledge this is the largest reported series of open arthrolysis cases after TKR with the longest follow-up. No patient in our series has required revision surgery, with all its increased complications, for stiffness.

We feel a meticulous open arthrolysis, performed in a stepwise manner with consideration to selective patella resurfacing and/or tibial insert downsizing is a valid treatment strategy for this difficult and poorly understood problem. It gives a significant and sustainable improvement in ROM. We support the use of open arthrolysis after TKR and feel it is an effective and reproducible technique in the treatment of arthrofibrosis.

Table 1. Comparison of pre-operative demographics

	Arthrolysis (n=13)	Series (n=2022)
Mean Age (years)	65	67
Mean Range of Movement (degrees)	8-110	6-109
KSS (/200)	103	98

Table 2: Range of movement (values in degrees)

Patient	Pre-op	Pre-arthrolysis	Wait for Arthrolysis (months)	6 months post-arthrolysis	Last follow-up	Follow up (years)
1	15-120	5-70	15	0-110	0-95	2
2	0-90	20-50	10	2-95	0-90	3
3	20-125	20-40	19	5-95	0-90	5
4	5-100	15-45	6	0-90	0-95	5
5	5- 115	5-65	12	0-95	0-115	6
6	5-125	5-65	20	7-65	0-95	6
7	5-120	5-70	21	0-70	0-75	7 (died)
8	0-130	0-70	14	0-90	0-105	10
9	0-130	5-80	10	0-95	0-100	10
10	10-105	25-95	7	0-125	0-100	10
11	Not recorded	10-80	15	0-85	0-108	10
12	10-130	20-70	18	5-100	5-80	10
13	10-90	5-80	10	0-90	0-100	10

Table 3: Knee Society Score

Patient	Pre-op /200	Pre-arthrolysis /200	Last Follow Up (years)	Last Follow Up Clinical Score /100	Last Follow Up Function Score /100
1	104	157	2	94	90
2	118	140	3	63	55
3	81	127	5	73	50
4	102	154	5	94	70
5	101	Not recorded	6	93	90
6	104	146	6	94	45
7	102	177	7 (died)	70	55
8	120	154	10	98	80
9	114	Not recorded	10	95	100
10	97	115	10	75	60
11	Not recorded	169	10	96	90
12	96	109	10	60	60
13	98	174	10	75	90

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