

# Outcome of Thompson's Quadricepsplasty for Extension Contracture of Knee

Dr. P. Pal<sup>1</sup>, Dr. G. Chatterjee<sup>2</sup>

<sup>1</sup>Assistant professor, Department of Orthopaedic Surgery, VIMS, RKMS, Kolkata, India

<sup>2</sup>Post-Graduate Trainee, Department of Orthopaedic Surgery, VIMS, RKMS, Kolkata, India

**Abstract:** *Introduction:* Stiffness of the knee after trauma and/or surgery for femoral fractures is one of the most common complications and is difficult to treat. Stiffness in extension is relatively common than flexion and can be conservatively managed by vigorous physiotherapy at an early stage. If it does not improve then quadricepsplasty is indicated which is done by various surgical techniques such as V-Y plasty, Judet, Thompson and modified Thompson quadricepsplasty. *Methods:* This study reports the clinical outcomes of 5 patients of post traumatic post-surgical extension contracture of knee with 10° to 30° range of movement. We performed Thompson's quadricepsplasty for all patients followed by rigorous physiotherapy protocol. The final improved knee flexion was classified according to Judet's criteria; excellent defined as >100°, good when >80° and <99°, fair when >50° and <79°, and poor when <50°. *Results:* Patients were followed up for an average of 23 months. The final mean gain in range of flexion was 73° (50° to 90°). According to Judet's criteria, there was one excellent (20%), four good (80%) results. There were no significant surgical complications. *Conclusions:* Thompson's quadricepsplasty followed by a strict and rigorous postoperative physiotherapy protocol can successfully increase the range of knee flexion in post-traumatic and/or post-surgical knee extension contracture.

**Keywords:** Knee stiffness, Thompson's quadricepsplasty, passive flexion and extension exercises

## 1. Introduction

A stiff knee is a complication of a fracture of the femur and/or surgery and challenging to treat. This is especially more with associated gross soft-tissue injuries, multiple fractures, comminuted fractures and if rehabilitation is delayed.<sup>1, 2</sup> Nicoll (1963) suggested that adhesions may be between the vastus intermedius and the femur or between the patella and the femoral condyles, or there may be a contracture of the medial and lateral retinacula or of the rectus femoris. Knee stiffness has been associated with external fixators with or without crossing the knee joint as well as intramedullary or extramedullary fixation for distal femoral fractures.<sup>3</sup> Knee flexion less than 45° causes problems in gait and daily activities. Some degree of knee movements can be achieved by gentle manipulation under anaesthesia but there are chances of hemarthrosis and recurrence of stiffness. Rigorous physiotherapy may gain movements sufficient for routine activities but failure is common. Thompson and Judet type of quadricepsplasties are the most common surgical procedures described to treat knee stiffness, the former being more popular.<sup>4</sup> This article reports the clinical outcome of 5 patients of post traumatic post-surgical extension contracture of knee who underwent Thompson's quadricepsplasty and post-operative physiotherapy.

## 2. Materials and Methods

Five patients with post traumatic knee stiffness were treated between January 2010 to April 2015. All the patients were male with mean age 30 years. In all cases stiffness developed as a result of trauma (distal femur fracture) and subsequent treatment. One patient with open fracture was treated with external fixator, two developed post-operative stiffness following internal fixation with plating in severely comminuted distal femoral fractures, one had intramedullary

nailing and subsequent infection with multiple sinus tracts formation around knee and one had internal fixation with plating for femur fracture and external fixator for open proximal tibia fracture. The mean interval between the initial operation and quadricepsplasty was 23 months. The preoperative active flexion of knee ranged from 10° to 40° (average 25°) and mean range of movement was 23° (10° to 30°). The range of movement of the knee was measured at each visit using a goniometer. Active and passive knee range of motion, patellar movement and any tightness of quadriceps over healed scar or sinus or pin tract side were assessed by thorough preoperative clinical examination whereas any articular incongruity or break in cortex of femur or any fracture callus was adjudged radiologically to apprehend the site of probable adhesion. After the surgery and thorough physiotherapy follow up was done for an average of 23 months and the final results were assessed by Judet's criteria: excellent, if flexion was greater than 100°; good, from 81° to 100°; fair, from 50° to 80°; and poor, if less than 50°.

## 3. Surgical Procedure

Patients were operated under spinal anaesthesia in supine position without tourniquet. A midline incision was made extending from upper one third of the anterior aspect of thigh up to the tibial tuberosity. Extra-articular as well as intra-articular adhesions were found in all cases. Extensor expansions of the knee were released on both sides of the patella and intra-articular fibrotic band-like adhesions were released. Vastus lateralis and vastus medialis were isolated from rectus femoris up to upper third of thigh. Rectus femoris was separated from vastus intermedius and from the anterior surface of the femur and upper pole of the patella [Figure 1]. The vastus intermedius was released and excised extraperiosteally. Small projecting bony spikes on anterior surface of femur were removed by nibbling. Following

excision of vastus intermedius raw bone surface was covered by fat graft and gentle manipulation was performed to achieve knee flexion of atleast more than 90° [Figure 2]. Haemostasis was achieved and negative suction drains were placed to prevent hematoma formation. Few loose stitches were applied to appose the retinaculum on the sides of the

patella keeping the knee flexed around 90° and skin closure was done. After skin closure, range of knee movements were in average 13° less than achieved peroperatively. We avoided V-Yplasty of rectus femoris in any patient as it can be a cause of extension lag.



**Figure 1:** Rectus femoris isolated from Vastus intermedius



**Figure 2:** Knee in more than 90° flexion prior to closure

#### 4. Post-Operative Procedure

In all the cases wounds were dressed by Jones compression bandage and a long knee brace applied over the bandage. In the immediate postoperative period limbs were raised on Braun-Bohler's splint and pillows and ice packs were applied for 48 hours. From 2nd post-operative day onwards knee was kept in extension by the aid of long knee brace only at night and during the day period active, assisted and passive knee ROM exercises was advised. Intravenous analgesics were given on the first three postoperative days and further oral analgesics were continued for another two weeks. Patient was discharged after achieving 90° flexion and that is usually 2 to 3 days after the stitch removal. After discharge from the hospital additional knee flexion and

quadriceps strengthening exercises, isometric quadriceps exercises, hamstring exercises including cycling were encouraged at homes for another six months and reviewed at regular interval in outpatient department. Patients were kept non weight bearing for two weeks after stitch removal. After one month from operation patients were gradually taught to sit in chair and then to squat. They were followed every month for the first three months and subsequently at six-monthly intervals for at least one year. We could not use CPM machine due to financial constraint. The average hospital stay was 18 days and average follow up was for 23 months.



## 5. Results

In Table 1. Results are discussed in details. The pre-operative active flexion ranged from 10° to 40° (average 25°). The per-operative flexion was 100° to 120° (average 106°). After an average 23 months of followup , the active flexion ranged from 90° to 105° (average 98°) [Figure 3.a and 3.b and Figure 4.a and 4.b]. The final mean gain in range of movement was 73° (50° to 90°). Between operation and the last follow-up, the mean loss of movement was 8° (0° to 15°). One patient had pre-operative 10° extensor lag which did not improve after operation. 10° extensor lag occurred after operation in one patient. According to Judet's criteria, there was one excellent (20%), four good (80%) results.



**Figure 3 (a):** Pre-operative picture showing 10° extensor lag (Case 5)



**Figure 3 (b):** Pre-operative picture showing 40° knee flexion (Case 5)



**Figure 4 (a):** Post-operative picture showing same extensor lag (Case 5)



**Figure 4 (b):** Post-operative picture showing 90° flexion (Case 5)



**Figure 5:** Post-operative picture on day 5 showing 75° knee flexion (case 3)

### Complication

One patient had superficial wound infection with serosanguinous discharge which was treated with regular dressing and appropriate IV and local antibiotics according to culture sensitivity. It resolved within two weeks. There was no skin necrosis or neurovascular deterioration in any of the patients.

**Table 1**

Pt. no.	Age (yrs.)	Primary Treatment following fracture femur	Pre-op flexion(deg.)	Intra-op flexion(deg.)	Follow up (mnth)	Final flexion (deg.)	Flexion loss (deg.)	Final gain in flexion (deg.)	Result
1.	22	Rush nail	30	120	28	105	15	75	Exec.
2.	28	Plating	10	110	36	100	10	90	Good
3.	29	Plating	20	100	23	100	0	80	Good
4.	37	POP cast	25	100	19	95	5	70	Good
5.	32	Plating (femur) and Ex-fix (tibia)	40	100	10	90	10	50	Good

## 6. Discussion

Post traumatic and /or post-surgical knee stiffness often leads to severe disability that hinders activity of daily living of the patient. Knee flexion of less than 70° compromises normal gait and produces limping. The conditions limiting knee flexion includes adhesions from deep surface of patella to femoral condyles, fibrosis and shortening of the lateral expansions of the vasti and their adherence to the femoral condyles, scarring and fibrosis of vastus intermedius, adhesion of this with underlying femur or overlying rectus femoris and shortening of rectus femoris.<sup>5,6</sup> Adhesion of the skin to underlying muscles particularly at pin and scar site in open fractures treated with external fixators and fracture callus also causes of limitation of flexion.<sup>4</sup>

Thompson (1944) described a surgical procedure which is based on isolating rectus femoris completely from the vasti and excising scarred vastus intermedius along with releasing adhesions in vastus lateral expansions.<sup>7</sup> Judet in 1950s also described quadricepsplasty technique for extension knee contractures but the former has been more popular over the years. Later in 1980s V-Y plasty was described by Blasius but lengthening of quadriceps may lead to extensor lag which has been widely reported in the literature.<sup>5, 6, 8, and 9</sup>

Meticulous extra periosteal dissection and excision of vastus intermedius from bone and the separation of rectus femoris is essential in achieving intra-operative knee flexion according to Thompson. Therefore release should be aimed at both intra-articular and extra-articular sites and should extend up to the upper third of the thigh. Any protruding bony fragment on the anterior aspect of distal femur was excised and the raw bone was covered with fat graft and stitched to neighbouring soft tissues to allow proper excursion of rectus femoris muscle over the bone. Meticulous haemostasis, use of cautery for dissection, negative suction drain, use of ice-packs and elevation of limb postoperatively to decrease the chances of oedema and swelling and is of utmost importance to minimise formation of adhesions and loss of achieved flexion.<sup>4,10</sup> We avoided V-Y plasty to prevent extensor lag.

The importance of knee quadriceps as well as hamstring exercises should be taught to the patient in preoperative period and it should be emphasized that these will later be required in the immediate postoperative period. These exercises will prevent the quadriceps inhibition in the painful postoperative period. Continuous passive motion if available and vigorous postoperative active knee exercises reduce the formation of adhesions, prevent quadriceps inhibition, allow gain in knee flexion and decrease the chances of extensor lag. Though the patient should be explained preoperatively that the gain of knee range of flexion may be at the cost of a persistent mild extensor lag.<sup>4, 6, and 11</sup>

As there have been a number of surgical techniques described for knee stiffness, several studies have also been done by pioneer groups and many others. Judet *et al.*<sup>12</sup> reported 53 cases with 85% (45 patients) good to excellent results. Nicoll reported only 33% patients had good or excellent results.<sup>6</sup> Hesketh reported results of Thompson's

quadricepsplasty in 10 patients and achieved excellent result except one which was fair.<sup>13</sup> Ali *et al.*<sup>4</sup> treated 10 patients by Judet's technique and reported 90% good to excellent result. Wang *et al.*<sup>14</sup> operated 22 patients by their innovative technique and achieved excellent results in 73% cases (16 patients). In our small study we also found 100% good to excellent result.

The success of quadricepsplasty depends both on the surgeon as well as the patient. With proper pre-operative patient education on knee exercises and sensitization about probable mild extensor lag; intra-operative meticulous sharp dissection and haemostasis, rigorous postoperative physiotherapy protocol in conjunction with motivation and ability of the patient to prevent quadriceps inhibition as well as to allow strengthening of the quadriceps and hamstrings muscles; Thompson quadricepsplasty can be a very effective surgical procedure for post traumatic and/or post-surgical knee extension contracture.

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