



# Arthroscopic Lysis of Adhesions Improves Knee Range of Motion after Fixation of Intra-articular Knee Fractures

Daniel Gittings MD<sup>1</sup>  
Patrick Hesketh BS<sup>1</sup>  
John Kelly IV MD<sup>1</sup>  
Samir Mehta MD<sup>1</sup>

<sup>1</sup>Department of Orthopaedics  
University of Pennsylvania  
3737 Market Street, 6th Floor  
Philadelphia, PA 19104

## Introduction

Intra-articular fractures about the knee often necessitate surgical reduction and stabilization. Arthrofibrosis requiring surgical intervention after intra-articular trauma involving the knee has been reported to be as high as 14.5%, and patients with prolonged application of external fixation are at the highest risk for developing arthrofibrosis.<sup>1-10</sup>

The average knee range of motion (ROM) motion has been reported to be 107 degrees after intra-articular distal femoral fractures and 105 degrees after proximal tibial fractures, while the arc of motion of a normal knee is 0 to 135 degrees.<sup>8,12,13</sup> In general, flexion from 0 to 125 degrees is sufficient for daily activities, including sitting and stair climbing.<sup>13</sup> Small impairments of ROM of the knee can cause gait disturbances and significantly increase the energy expenditure required for daily activity.<sup>14</sup>

Traditional treatments for arthrofibrosis after intra-articular fractures about the knee include manipulation under anesthesia (MUA), open quadricepsplasty, and surgical arthroscopic lysis of adhesions (SALKA). Although SALKA has been described to treat posttraumatic knee arthrofibrosis, to date there are no studies describing this procedure's efficacy.

The purpose of this study was to examine the immediate and sustainable range of motion (ROM) changes after surgical arthroscopic lysis of knee adhesions for post-traumatic knee stiffness after open reduction internal fixation.

## Materials & Methods

This study is an IRB approved retrospective review of a consecutive series of patients at a single institution with arthrofibrosis after internal fixation about the knee (tibial plateau, patella, distal femur) who underwent SALKA from 2009-2014. 13 qualifying patients were identified (mean of 35 years, range 22-67 years) that underwent SALKA for posttraumatic knee stiffness. The primary outcome variable was change in knee ROM following SALKA both immediately after surgery and at latest follow up. Factors including gender, age, body mass index, tobacco use, laterality, associated injuries, immunocompromised status, and times from surgical fixation to SALKA and from SALKA to last follow up were evaluated. Statistical

analysis was performed using one tailed paired Student's *t* test for pre- and post-operative group comparison. An *a priori* power analysis was performed.

ROM was assessed under general anesthesia prior to SALKA in all cases. Standard anterolateral and medial portals were made with occasional use of posterior, trans-septal, and suprapatellar portals as deemed necessary. Adhesions were lysed using a radiofrequency ablative device in the medial, lateral, posterior, and suprapatellar compartments. Special care was taken to release the quadriceps off the femur with an elevator through additional superior parapatellar portals. After lysis, manipulation was performed using the proximal tibia as the primary lever. Force was applied in a controlled graduated fashion at the knee. Manipulation was used to achieve a minimum of 110 degrees of flexion. ROM was assessed after SALKA while the patient was still sedated under anesthesia.

## Results

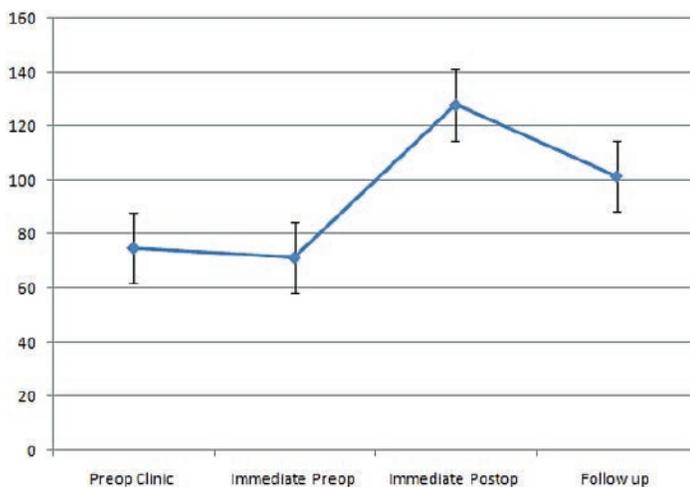
The patients included 9 (69%) males and 4 (31%) females. Mean time between ORIF and SALKA was 245 days (range, 84-509 days). Average follow up after SALKA was 137 days (range 8-782 days). Injuries leading to SALKA included 9 (69%) tibial plateau fractures, 3 (23%) patella fractures and 1 (8%) distal femur fracture. Patient demographics are summarized in Table 1. In order to detect a large effect size, Cohen's D 1.15, assuming a type-I error rate of 0.05 and a power of 0.80, we would need to enroll a minimum of 11 patients in this study to compare preoperative to postoperative ROM.

Prior to SALKA, the mean ROM arc was 75 degrees (range 5-118 degrees; SD = 30 degrees) in the office. The mean ROM arc was 72 degrees (range 40-110 degrees; SD = 23 degrees) under sedation immediately prior to surgery. The mean intraoperative arc of motion achieved at the time of SALKA was 128 degrees (range 40-110 degrees; SD = 23 degrees). The mean intraoperative improvement was 56 degrees (range 25-95 degrees; SD = 25) ( $p < 0.0001$ ). At the most recent follow up, the mean ROM arc was 101 degrees (range 30-140 degrees; SD = 29 degrees). The mean improvement of ROM arc from office visit prior to SALKA to latest follow up visit was 26 degrees (range 0-69 degrees; SD

**Table 1: Descriptive Statistics of All Patients in the Study Population**

<b>Average Age (years)</b>	35(22–26)
<b>Gender</b>	
Male	9 (69%)
Female	14 (31%)
<b>Time between ORIF and Lysis (days)</b>	245 (84–509)
<b>Follow up time since Lysis (days)</b>	137 (8–72)
<b>Fracture Type</b>	
Tibial Plateau	9 (69%)
Patella	3 (23%)
Intra-articular distal femure	1 (8%)
<b>Laterality</b>	
Right	6 (46%)
Left	7 (54%)
<b>Comorbidities</b>	
Smoker	3 (23%)
Diabetes Mellitus	0 (0%)
Cardiac Disease	0 (0%)
Polytrauma	
Obesity	0 (0%)
Immunocompromised	0 (0%)

= 25 degrees)( $p = 0.001$ ). An average of 27 degrees (range -5-95 degrees; SD = 27,  $p = 0.002$ ) was lost between immediate post-operative ROM and that at the most recent follow up (Figure 1). One patient gained 5 degrees of motion from immediately after SALKA to the latest follow up.

**Figure 1.** Range of Motion Before and After SALKA.

## Discussion

Traditional treatments for arthrofibrosis after intra-articular fractures about the knee include MUA, open quadricepsplasty, and SALKA. While there are previous series on the efficacy of MUA and open quadricepsplasty for treatment of posttraumatic knee arthrofibrosis, to our knowledge, there are no reports regarding the efficacy of SALKA.<sup>15-16</sup>

This study is limited as a retrospective chart review with a small sample size ( $n = 13$ ). Despite an *a priori* power analysis showing that this study was adequately powered, our study was powered only to detect large effect sizes. As a surgical procedure, SALKA can be quite variable with patients having a variety of demographics, co-morbidities, and types of previous internal fixation procedures. These factors limited our ability to make specific conclusions regarding the true impact of patient risk factors on ROM before and after SALKA. Nevertheless, given that each patient were measured against themselves, the efficacy of SALKA can be assessed.

SALKA improved ROM intra-operatively from an average of 72 degrees immediately before surgery to 128 degrees directly after surgery or a 56 degree (78%) improvement in total ROM. All patients in this cohort showed improvement of ROM immediately after surgery. At latest follow up visit, mean ROM was 101 degrees or 26 degrees (35%) of sustained improvement in total ROM from the preoperative visit. At latest follow up, patients lost an average of 27 degrees of ROM from immediately after SALKA. This decrease in ROM from immediately after SALKA to latest follow up visit is biased by the fact that the immediate post-operative measurement was obtained intra-operatively while the patient was still anesthetized.

Our results are comparable to MUA and open quadricepsplasty for posttraumatic knee arthrofibrosis where an average improvement of 64 degrees and 76.3 was seen immediately after these respective procedures. MUA and open quadricepsplasty lost 13 degrees and 25 degrees respectively from immediately postoperatively to latest follow up.<sup>15-16</sup> Although there are no reports for SALKA for posttraumatic arthrofibrosis after ORIF, our results are comparable to SALKA for arthrofibrosis after total knee arthroplasty (TKA). A systematic review reports that that SALKA increases average ROM ranging from 16.5 - 60 degrees for treatment of the stiff TKA.<sup>17</sup>

## Conclusions

SALKA for arthrofibrosis of the knee after articular fracture fixation increases range of motion. This improvement in ROM is similar to results found in MUA and open quadricepsplasty. While an improvement from pre-operative ROM is obtained, the ROM gains in all 3 procedures diminish over time. SALKA offers an advantage over MUA in that arthroscopy allows the surgeon to examine and treat soft tissue impingement, loose bodies, or adhesions under direct visualization. SALKA is also less morbid than open quadricepsplasty. Although SALKA shows promising results, this technique may be technically challenging as it may require a surgeon to use posterior,

trans-septal, and suprapatellar portals. Indications for MUA, quadricepsplasty versus SALKA for treatment of posttraumatic arthrofibrosis are unclear. Future research may directly compare these three procedures and develop a protocol for their specific indications in treatment for posttraumatic knee arthrofibrosis after ORIF.

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