

Timing of manipulation under anaesthesia for stiffness after total knee arthroplasty

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Abstract: Stiffness following total knee arthroplasty (TKA) is a debilitating condition for the patient with limitation of functional outcome. There are various causes of stiffness, which can be classified as pre-operative, per-operative and post-operative. Arthrofibrosis is one of the causes, which can be managed in different ways, and manipulation under anaesthesia (MUA) is routinely performed as the first line of management. The timing of MUA is often debated. We review the paper by Issa *et al.*, which looks at the effect of timing of manipulation on a stiff TKA. They conclude that early manipulation within 12 weeks of performing the TKA had a higher mean flexion gain (36.5°), higher final range of motion (ROM) (119°) and higher knee society score (89 points) compared to those performed after 12 weeks which were 17°, 95° and 84 points respectively. Other studies have also reinforced the idea that early manipulation within 12 weeks has a better outcome than those performed after 12 weeks. There may still be a benefit of manipulation until 26 weeks after which open arthrolysis may be needed to improve ROM.

Keywords: Arthrofibrosis; knee arthroplasty; manipulation; stiffness

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Introduction

Total knee arthroplasty (TKA) is a commonly performed procedure for the treatment of end-stage arthritis of the knee. The goal of this intervention is to achieve a stable, painless knee with a functional range of motion (ROM) (1). A ROM of 10° to 95° is considered functional for walking and climbing stairs (1,2) but a flexion of upto 115° may be required to perform some activities of daily living like tying shoelaces whilst sitting down and of 95° whilst sitting on a chair (2). Regional differences also come into play here and in some parts of the world kneeling for prayers and sitting cross-legged requires more than 130 degrees of flexion.

Post-operative stiffness is a potentially disabling complication, which affects approximately 5-7% of patients undergoing a TKA (3). A number of factors have been proposed to have an impact on this complication. Risk factors for stiffness could be broadly classified into (I) pre-operative—stiff native knee, associated stiffness of the hip,

history of multiple previous operations; (II) per-operative—posterior cruciate ligament tightness in cruciate retaining prosthesis and technical issues like imbalance of flexion/extension gaps, inappropriate amount of bone resection, improper component positioning, instability, anteriorly sloped tibial cuts, improper component size, overstuffing of patello-femoral joint, and component mal-alignment (1,4); and (III) post-operative—poor patient motivation, inadequate physiotherapy, complications like infection, reflex sympathetic dystrophy, heterotrophic ossification, instability, and arthrofibrosis (1,4).

It is very important to accurately diagnose arthrofibrosis as the cause of stiffness prior to commencing any treatment for these patients. Arthrofibrosis can be managed with one of the four available options—(I) manipulation under anaesthesia (MUA), (II) arthroscopic arthrolysis, (III) open arthrolysis and (IV) revision TKA (1,4). MUA is usually the first line of management as it is non-invasive, however the long term effects have not been evaluated (5). The timing

of MUA for stiffness after TKA is often debated ranging from 2 weeks after the index operation to up to 4 months following the index procedure (6). Some studies suggest that MUA performed before 12 weeks leads to significant improvement in ROM and greater final flexion compared to those performed after 12 weeks (4,5). And interestingly some studies also report that there is no difference between MUA performed early or late (7).

This editorial reviews the article by Issa *et al.* published in the *Journal of Bone and Joint Surgery* in April 2014 entitled “The Effect of Timing of Manipulation under Anaesthesia to Improve Range of Motion and Functional Outcomes Following Total Knee Arthroplasty” (5). A total of 2,128 total knee arthroplasties were performed at their institution between 2005 and 2011. Among these 149 consecutive MUAs were identified. A total of five patients were excluded from the study, four due to having flexion contractures $>10^\circ$ and one patient for sustaining undisplaced supracondylar fracture, who was managed conservatively in a cast brace. Bilateral TKAs were performed in eleven patients. A standard medial para-patellar approach was used for all patients. Three different types of cemented total knee prostheses were used. All the patients routinely underwent post-operative physiotherapy. Patients with ROM $<110^\circ$ at 6 weeks post-operatively were offered MUA. Manipulations were performed only in those patients who had no evidence of infection, component mal-position or technical failures during the TKA. MUA was also not performed in low demand patients or in those with evidence of anterior femoral notching (5).

A standard technique of manipulation was used in all patients after adequate anaesthesia and muscle relaxation, as described by Fox and Poss (8). Patients who underwent MUA were divided in two groups—early and late depending on whether the MUA was performed before 12 weeks or after from the index operation respectively. These patients were further sub-divided into four groups—Group I to IV depending on the timing of MUA: I, <6 weeks; II, 6-12 weeks; III, 13-26 weeks; and IV >26 weeks. All patients were allowed full weight bearing in the immediate post-operative period. A standard post manipulation rehabilitation protocol was followed in every patient, which included 2 weeks of continuous passive motion and 4 weeks of quadriceps strengthening exercises. All patients were followed up at 6 weeks, 6 months and yearly thereafter.

There was a significant gain in the mean flexion in both the early and the late MUA groups. Early manipulation

within 12 weeks of performing the TKA had a higher mean flexion gain (36.5°), higher final ROM (119°) and higher knee society score (89 points) compared with those performed after 12 weeks which were 17° , 95° and 84 points respectively. The mean gains in flexion in the early MUA group were twice compared to the late MUA group, which was statistically significant. The mean Knee Society objective and function scores were significantly higher in the early group compared to late MUA group. The study by Issa *et al.* (5) also showed comparable improvement in ROM between patients with pre-operative ROM of $<90^\circ$ and $>90^\circ$ independent of several factors like age, sex, race, body mass index, surgeon, prosthesis type and comorbidities. However, Yeoh *et al.* in their study had found no difference in mean gains in ROM after MUA performed before or after 12 weeks (7). This was also supported by the study by Keating *et al.* (9).

Indication for MUA in this study was ROM $<105^\circ$ at 6 weeks after TKA. However, other studies have used a ROM of $<90^\circ$ as an indication for MUA but at different post-operative periods varying from 4 weeks to 2 months (10-13). This may mean that the number of patients undergoing MUA in this study may be higher compared to others, which may have a bearing on the final mean gains in ROM. Elevated joint line, component mal-alignment, infection, intolerance to anesthesia were absolute contraindications for MUA in this study and failed previous MUA, osteoporosis, anterior femoral notching or low demand patient were relative contraindications (5). Yercan *et al.* suggested radiographs; laboratory investigations and bone scan to rule out infection, algodystrophy or surgical error, which are absolute contraindications for MUA (4).

One patient in the study by Issa *et al.* (5) was excluded from this study because of an undisplaced supracondylar femoral fracture during the MUA. Even though MUA is the standard initial procedure for the management of stiff TKA due to arthrofibrosis, care needs to be taken to perform this procedure appropriately and carefully to avoid complications. Wound dehiscence, patellar ligament avulsion, haemarthrosis, heterotopic bone formation, supracondylar femoral fracture and pulmonary embolism are complications, which have been associated with the procedure (2,7).

Several authors have mentioned MUA as the first line on management of arthrofibrosis after TKA (4,6,7,14,15). However, Arbuthnot and Brink have reported using arthroscopic arthrolysis as the first line management of arthrofibrosis with good short-term outcome (16). The study by Issa *et al.* (5) showed a difference in the

distribution of patients between early and late MUA groups with regards to age of the patient, smoking status and presence of cardiac disease but the nature of the distribution has not been mentioned in the paper (5). However other authors have suggested that the stiffness is associated with some factors, such as age, gender, genetic predisposition, socioeconomic status (15,17). Diabetes mellitus has been shown to be associated with stiffness by Yercan *et al.* (4) and Scranton (15). The study by Pfefferle *et al.* does not show any association between stiffness and diabetes mellitus but shows an association with obesity and nicotine use (17). Patients with two or more previous operation on the knee showed statistically significant worse results with regards to absolute knee flexion and gains in knee flexion compared to those with one or two previous operations (18). Ipach *et al.* also showed that a flexion <70° prior to MUA did not result in gains in flexion (18).

In conclusion, this study by Issa *et al.* reports that the outcome of MUA for arthrofibrosis after TKA is better if performed early. Certainly, comparing the studies in the literature (14) with the current study, this is a well-designed study with a large cohort of patients and the results obtained are therefore robust. We would therefore support the view that for patients who develop arthrofibrosis following a TKA, an early (<12 weeks) MUA should be the first line of management. The MUA should only be performed after ensuring there is no technical flaw in the arthroplasty and that there is no evidence of infection and complex regional pain syndrome. Furthermore, despite doing the MUA early there is no clarity in the literature as to whether the gain in ROM is maintained over a period of time in these individuals. Finally, more studies need to be performed, preferably prospective, to define the best time to perform an MUA for arthrofibrosis following a TKA and assess its long-term outcome.

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Footnote

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to declare.

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