Research Article

Early Manipulation Under Anaesthesia for Limitation of Flexion Following Total Knee Arthroplasty: A Comparison Before and After Day 45 Post-Surgery

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Abstract

Purpose: The aim of this study was to evaluate the effectiveness of early MUA for flexion contracture following total knee arthroplasty (TKA). Our hypothesis was that such manipulation would allow faster and better recovery of range of motion (ROM) of the joint, with no additional morbidity, and with lasting results.

Methods: Between 2008 and 2015, 65 patients of average age 66 ± 8 years (47-87), 42 females and 23 males, were manipulated under anaesthesia for flexion contracture following TKA. Two groups were formed: group 1, consisting of 36 patients, underwent MUA before day 45 post-surgery and group 2, consisting of 29 patients, underwent MUA after day 45 post-surgery. The average wait time before manipulation, including the time to schedule the operation was 39 ± 5 days (27-44) for group 1 and 54 ± 5 days (47-60) for group 2.

Results: In group 1, at a mean follow-up time of 30 months (6-120), mean flexion was 117 ± 12° (95-140°), i.e. a final gain of 76° flexion (50-125°). Regarding group 2, at a mean follow-up time of 21 months (6-78), mean flexion was 109 ± 14° (80-135°), i.e. a final gain of 45° flexion (5-70°). Final flexion and final gain were both statistically better in group 1 than in group 2 (p=0.04 and p=0.002).

Conclusion: Manipulation under anaesthesia before day 45 post-surgery, to treat flexion contracture following TKA, provides excellent and long-lasting functional results. The results are better than when performed later than day 45.

Level of evidence: IV, retrospective study

Keywords: stiffness, arthrofibrosis, knee, arthroplasty, manipulation, anaesthesia

Introduction

Stiffness is a common complication of knee replacement surgery, occurring in 8 to 60% of total knee arthroplasties (TKA) [1]. It leads to a reduction in joint mobility, especially in flexion, sometimes extension, and sometimes both-with or without associated pain. There is no consensus at present regarding diagnosis of knee stiffness
due to joint arthrofibrosis. However, some authors refer to the following ranges: <75° flexion; <95° flexion; range of motion <70° [2-5]. There are numerous risk factors [6-8], but primarily: post-operative pain, early infection, post-operative haemarthrosis, and poor rehabilitation. Once set in, the damage is above all functional, with difficulty climbing and descending stairs, sitting down or standing up [9]. Physiotherapy alone is not enough to relieve stiffness as Esler et al. [10] showed in their article. Other therapeutic options include manipulation under anaesthesia (MUA), and arthroscopic or open arthrolysis. In the most severe cases, joint stiffness can lead to major discomfort requiring revision surgery, with mediocre results [11,12].

MUA is a short and fast procedure providing immediate recovery of a satisfactory range of motion in cases of post-surgical or post-traumatic stiffness [13,14]. Its complications vary in severity [15], and their risk of occurrence lowers when a maximum deadline of 3 months [4,16,17] or even 2 months [18] from the initial surgery is respected. While manipulation generally offers a satisfactory range of motion under anaesthesia, and immediately post-surgery, the long-term result can sometimes be disappointing, with no identifiable cause. Given the difficulties we had previously manipulating certain TKAs after 2 months or more, we arbitrarily set that it would be better to do a MUA before 45 days than later.

The hypothesis of the study was that the sooner one mobilizes the knee, the better the results. The aim of this article was to compare 2 groups of patients with knee flexion stiffness after TKA. Group 1 was manipulated before day 45 post-surgery and group 2 after day 45 but no later than day 60.

Materials and Methods

Data series

This is a retrospective, monocentric, non-randomised, transverse, observational cohort study, approved by the local ethics committee. From early 2008 to late 2015, of 1214 patients who underwent a primary TKA (e-Motion FP™, B-Braun-Aesculap, Tuttlingen, Germany), 65 (5.4%) were manipulated under anaesthesia for flexion contracture of the knee, including 42 females and 23 males, with an average age of 66 ± 8 years (47-87). All patients were operated on by the same surgeon (DS), who also carried out all the MUAs. Inclusion criteria were a flexion range of less than 45° at 30 days follow up, or 75° between 45 and 60 days after TKA. Two groups were formed: group 1, consisting of 36 patients, underwent manipulation before day 45 and group 2, consisting of 29 patients, underwent manipulation after day 45. The time of manipulation between the two groups was purely random and only related to the date of first consultation after the surgery without any other consideration. The average wait time before manipulation, including the time necessary to schedule the operation was 39 ± 5 days (27-44) for group 1 and 54 ± 5 days (47-60) for group 2. Before TKA, average flexion was 121 ± 15° (70-145°) and average extension -4.5 ± 8° (-10-0°) with no difference between the two groups which were comparable in terms of general, surgical and post-operative characteristics. All the data regarding the series are summarised in Table 1.

| Table 1: Characteristics of the 2 groups before MUA |
|-----------------|-----------------|-----------------|-----------------|
|                  | Population      | Group ≤ 45 days | Group >45 days  | P value |
| (n=65)           | (n=36)          | (n=29)          |                 |        |
| Sex              |                 |                 |                 |        |
| Male             | 14              | 9               |                 | p=0.51 |
| Female           | 22              | 20              |                 |        |
| Age (years)      | 65.7 ± 8 (47-87)| 66.8 ± 7 (53-84)|                 | p=0.74 |
| BMI (kg/m²)      | 27.5 ± 5 (20.2-43.7)| 29.4 ± 5 (22.3-40.9)|                 | p=0.15 |
| Preoperative HKA angle | 175 ± 7° (154°-195)° | 176 ± 9° (157°-192)° |                 | p=0.39 |
| Postoperative HKA angle | 180 ± 2° (176°-186)° | 179 ± 2° (175°-184)° |                 | p=0.39 |
| Flexion before MUA | 41 ± 7° (15-45)° | 64 ± 13° (30-75)° |                 | <0.001 |
| Extension before MUA | -1 ± 2° (-10-0)° | -1 ± 2° (-5-0)° |                 | p=0.5  |
| ROM before MUA   | 40 ± 7° (15-45)° | 63 ± 13° (30-75)° |                 | <0.001 |

BMI: Body Mass Index; HKA: Hip-Knee-Ankle; ROM: Range of Motion; MUA: Manipulation Under Anaesthesia
After surgery, the patients were discharged from the hospital between day 6 and day 8 and were reviewed between day 30 and day 40. If flexion was below 45°, a MUA was scheduled quickly. If flexion was around 70°, the patient was reviewed 15 days later in order to schedule a MUA if flexion remained below 75°. 65% underwent in-patient rehabilitation and 35% home-based rehabilitation.

Methods

MUA was performed gently and progressively. While the patient was under anaesthesia, the physician flexed the hip to 90° or more and progressively flexed and extended the knee while receiving auditory and tactile feedback of the adhesions breaking away, culminating in several 20 to 30-second holds at the new maximal knee positions. The manipulation was stopped if any major resistance was felt.

A femoral nerve block (with an additional sciatic nerve block for 4 patients, i.e. 6% of cases) was applied, immediately prior to the manipulation, and the patient then positioned on a motorised splint for passive continuous motion for 3 days (all day and night, except during walking and active rehabilitation with the physiotherapist). Painkillers and Nonsteroidal Anti-inflammatory drugs (NSAIDs) were prescribed for one week with no anticoagulants. Discharge was allowed as of day 4 post-manipulation-preferably to an in-patient rehabilitation facility (74% versus 26% discharged home).

At the final follow-up, all patients consented to be reviewed by an independent observer. No subjects were lost to follow-up. During said review, a clinical examination was carried out to measure knee range-of-motion using a goniometer as for the previous measures. An International Knee Society (IKS) score was systematically reported, assessing patient satisfaction regarding the manipulation carried out, subjectively and objectively.

All results were analysed using the Microsoft Office Excel™ (Redmond, USA) and SPSS® (SPSS Inc, Chicago) software packages. The series’ characteristics were described using averages and standard deviations for continuous variables and using percentages for categorical variables. Student’s t-test was used to compare quantitative data and Pearson correlation was used for categorical data. Results were considered significant with an alpha level of 5% (p<0.05).

Results

Regarding complications, we noted 3 spontaneously-resolving haematomas and 2 deep-vein thromboses, requiring appropriate anticoagulation.

Immediately after MUA, the procedure provided an average flexion of 126 ± 10° (100-140°) for group 1, and 122 ± 13° (90-140°) for group 2. The initial gain was 86 ± 9° (65-100°) for group 1 and 58 ± 17° (30-105°) for group 2 (Table 2).

<table>
<thead>
<tr>
<th>Population (n=65)</th>
<th>Group 1 ≤ 45 days (n=36)</th>
<th>Group 2&gt;45 days (n=29)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time between TKA and MUA (days)</td>
<td>39 ± 5 (27-44)</td>
<td>54 ± 5 (47-60)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Flexion after MUA</td>
<td>126 ± 10° (110-140°)</td>
<td>122 ± 13° (90-140°)</td>
<td>p=0.7</td>
</tr>
<tr>
<td>Extension after MUA</td>
<td>0 ± 2° (-10-0°)</td>
<td>-1 ± 2° (-10-0°)</td>
<td>p=0.22</td>
</tr>
<tr>
<td>ROM after MUA</td>
<td>126 ± 9° (110-140°)</td>
<td>122 ± 15° (80-140°)</td>
<td>p=0.65</td>
</tr>
<tr>
<td>Final ROM gain</td>
<td>86 ± 9° (65-100°)</td>
<td>58 ± 17° (30-105°)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Follow up (months)</td>
<td>30 ± 30 (6-120)</td>
<td>21 ± 19 (6-78)</td>
<td>p=0.47</td>
</tr>
<tr>
<td>Flexion at last follow up</td>
<td>117 ± 12° (95-140°)</td>
<td>109 ± 14° (80-135°)</td>
<td>p=0.04</td>
</tr>
<tr>
<td>Extension at last follow up</td>
<td>-1 ± 2° (-10-0°)</td>
<td>-1 ± 2° (-10-0°)</td>
<td>p=0.79</td>
</tr>
<tr>
<td>ROM at last follow up</td>
<td>116 ± 12° (95-140°)</td>
<td>108 ± 14° (80-135°)</td>
<td>p=0.02</td>
</tr>
<tr>
<td>Final ROM gain</td>
<td>76 ± 14° (50-125°)</td>
<td>45 ± 18° (5-70°)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>IKS Score at last follow-up (points)</td>
<td>187 ± 19 (116-200)</td>
<td>185 ± 18 (123-200)</td>
<td>p=0.19</td>
</tr>
</tbody>
</table>

MUA : Manipulation Under Anaesthesia; TKA : Total Knee Arthroplasty; ROM : Range Of Motion; IKS : International Knee Society
At the average follow-up time of 30 ± 30 months (6-120) for group 1, mean flexion was 117 ± 12° (95-140°) and at the average follow-up time of 21 ± 19 months (6-78) for group 2, mean flexion was 109 ± 14° (80-135°) (p=0.04). Average final increase in knee range of motion was 76 ± 14° (50-125°) for group 1, and 45 ± 18° (5-70°) for group 2 (p<0.001). The mean overall IKS score was 187 ± 19 points (116-200) for group 1 and 185 ± 18 points (123-200) for group 2 (p=0.19). Subjectively, 61 patients (94%) were satisfied or very satisfied with MUA and the TKA.

With regard to the type of patient discharge, there was no correlation between discharge home or to in-patient rehab following the initial surgery and the range of motion before MUA (p=0.209), nor between discharge home or to in-patient rehab and the overall increase in range of motion (p=0.673).

**Discussion**

Early MUA to treat flexion contracture post-TKA offers excellent results both for recovery of flexion and for IKS score. The results are better when performed before than after day 45, even without exceeding 60 days. When performed before day 45, there is an average increase in flexion of 76°, with no complications. Furthermore, these results are stable over time, with a loss of range-of-motion of just 9° between the immediate post-op assessment and the final follow-up, which supports our initial hypothesis. The results of this study are in line with other published studies which report lasting improvement in knee range of motion following manipulation under anaesthesia [1,10,19-22]. The ideal time to propose MUA is difficult to pinpoint. It is dependent on several factors: 2 weeks with no improvement in flexion, flexion limited to 45-50° at 30 days post-op, a swollen knee with little patellar mobility, or fear of pain during rehabilitation.

Post-TKA wait times before performing MUA remain controversial. Certain authors have found MUA to be beneficial up to 90 days post-TKA [23,24]. The later MUA is carried out, the smaller the gain (p<0.001 in our series) whilst the risk of femur fractures increases [8], as well as the formation of periprosthetic arthrofibrosis [25,26]. This has led us to avoid exceeding 60 days for MUA, in order to avoid this type of complication [4,16,17], and to carry out MUA quickly, as soon as the procedure is indicated. Beyond 2 months, arthroscopic arthrolysis is preferable (within 6 months), or open arthrolysis (after 6 months) [1,27,28].

Any fears regarding negative effects of MUA are unfounded. In this series, with an average follow-up of more than 20 months in both groups, and extremes of 6 months and 10 years, average IKS score is very satisfactory (more than 180 points in both groups) and no early loosening was observed.

Following MUA, after a short stay on an orthopaedic ward, 74% of patients were discharged to a rehab centre and 26% were discharged home, with no difference in the final result. A randomised prospective study would, however, be required to conclude on these 2 types of care. Patients whose home-based rehab was insufficient went to a rehab centre at a later stage. Likewise, patients who were in a rehab centre when stiffness was diagnosed returned there to complete their rehabilitation. Similarly, no significant difference was observed immediately following surgery in the emergence of stiffness between patients who received home-based rehab (35%) and those who were treated in a specialist rehabilitation centre (65%).

The strengths of this study include the number of patients operated on by the same surgeon, with the same prosthesis model, the same surgical technique and the same post-operative protocol. Its weaknesses include the lack of control of post-operative rehabilitation, whether carried out in a rehab centre or at home, and the difficulties in evaluating patients’ psychological state, both pre- and post-operatively. Moreover, the mean follow-up time of both groups was different and more important in group 1 than in group 2. However, this potential bias must be weighted by the fact that no increase in flexion was found beyond 6 months after manipulation in both groups.
Conclusion

Manipulation under anaesthesia for post-operative flexion contracture of the knee following TKA, offers good, lasting results when carried out within 45 days. The increase in ROM is very satisfactory and the IKS score is not impacted by what can be seen as an aggressive treatment. Our results reveal a reduction in final ROM gain when the time between surgery and MUA is increased, favouring early intervention as soon as the procedure is indicated. To avoid missing the right time, we recommend examining patients 30 days after discharge from the hospital. Home-based rehab did not lead to greater stiffness than in-patient rehabilitation, but a randomised prospective study would be necessary to confirm this observation.

Conflict of Interest

The authors declare that there are no conflicting interests with respect to the research, authorship, and/or publication of this article.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

References