Tibial Alignment in Total Knee Replacement Surgery, Intramedullary Alignment Versus Extramedullary Alignment a Blinded Single Surgeon Study

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Abstract: Background: The clinical success of total knee arthroplasty is positively correlated with good component orientation. Controversy remains as to what is the best tibial alignment technique, this study compares the intramedullary versus the extramedullary surgical alignment guidance methods.

Material and Methods: A retrospective study was done on 100 patients during the time period 2007 to 2010. The knee replacements were performed by the same surgeon, 49 procedures were performed via the intramedullary technique and 51 procedures were via the extramedullary technique. The tibiofemoral angle was measured pre-operatively as well as post operatively, the tibial alignment angle was measured post operatively also, the results were then statistically analysed.

Results and Conclusion: There was no significant difference between both groups regarding the tibial alignment angles. Both techniques proved accurate in producing an acceptable post operative tibial component alignment angle. We advocate the surgeon may use his/her discretion when deciding upon the method of tibial alignment.

Keywords: Extramedullary, intramedullary, Tibial alignment.

INTRODUCTION

The world of total joint replacement arthroplasty strives to continue to improve in efficacy, efficiency, longevity, function and to improve the re-operation rates. These goals are no different when considering total knee replacement surgery. Total knee replacement (TKR) surgery is a well recognised surgical treatment option for the advanced stages in the process of rheumatoid or osteoarthritis. At present orthopaedics surgeons are treating a much younger population in need of a total knee replacement, it is not uncommon to see patients in their mid-30’s are requiring total knee arthroplasty. This younger population has prompted the authors to propose a study to determine the best technique for alignment of the tibial prosthesis. It is known that the femoral prosthetic alignment has been proven to be superior via the intramedullary method [1] however this is not the case for the tibia. It is also known that the overall alignment of the complete prosthesis governs the longevity of the implants and also governs the function a patient will experience. Accurate implant alignment is crucial particularly in younger more active patients [2].

Important angles of alignment for total knee replacement described in the literature [3] are:

1. Tibial femoral angle, an angle formed from the angle subtended between the femoral and tibial anatomic axis. Normal values 5-10 degrees.

2. The tibial component or the tibial tangent angle, the angle formed between a tangent to the tibial component and the tibial axis. Normal 90 degrees.

3. The femoral component angle, the angle formed between a tangent to the end of the femoral component and a line perpendicular to the femoral axis. Normal 5 degrees.

The senior author (JH) has a long standing practice of over twenty years at consultant level offering lower limb arthroplasty. All the early total knee replacements completed by JH initially were performed using the extramedullary method up until May 2009. Outside influences and peers in the field of lower limb arthroplasty encouraged JH to change technique. Thus JH reverted to the intramedullary method for the tibial alignment. After the generation of a significant number of participants, a retrospective study was performed in our centre to determine which method was superior in terms of alignment. This is a valuable study as we have controlled the differences in operating surgeon, operating centre and experience (which is seen in previous studies) by using a single surgeon and a single centre for all cases.

MATERIALS AND METHODS

For this retrospective data collecting study we declare all patients details are anonymous, the study is authorized by the local ethical committee and was performed in accordance with the ethical standards of the 1964 declaration of Helsinki as revised in 2000.

This is a single centre retrospective study; the senior author (JH) undertook a total of 100 total knee replacements...
In this study, the extramedullary group consisted of 51 patients over the period of nine months (from September 09 to May 2010). The average age was 71.9; there were 25 males and 26 females. The intramedullary group consisted of 49 patients over a period of 28 months (from May 2007 to August 2009). The average age was 69.5 years with 25 females and 24 males. For the extramedullary group there were 13 valgus knees 11 varus knees and 27 knees in neutral alignment. For the Intramedullary group there were 8 valgus 5 varus and 36 knees in neutral alignment pre-operatively. Therefore no sub group comparisons were performed as the subgroups were too small to take into separate consideration, also this shows that the preoperative measurements between the groups were of similar comparison.

The two groups were tested for homogeneity and were found to be non homogenous thus a Mann Whitney U test was performed on all group comparisons. Initially the groups were tested for their individual pre-operative tibial femoral angles, no significant difference was found (P = 0.781) between the groups pre-operatively, a P value of below 0.05 was taken to be significant. The comparisons between the measured post operative angles were also tested for statistical significance Via the Mann Whitney U tests and no significant differences were found here either. For the Tibial Femoral angles P = 0.829 and comparing the Tibial tangent angles P = 0.143.

**DISCUSSION**

In summary this study offers a unique comparison against two well used methods of tibial alignment when performing a total knee replacement. The direct comparison of the two methods was made whilst keeping the majority of other factors constant. The surgeon, the centre, implant materials, the approach and the post operative rehabilitation of the patients were all kept constant. The results obtained at our centre have directly compared the 2 differing methods and found very similar results regarding the two methods for TKR, whereby 13.7% (7/51) of the extramedullary TKR’s achieved a perfect 90 degrees tibial tangent angle and 22.4% (11/49) of the intramedullary achieved the perfect 90 degrees.

The limitations of the study include a small number sample size, use of the less accurate ‘standard length’ radiograph for review on PACS instead of the ‘long leg’ alignment view, this was done due to a study by Ishii et al [4] stated short radiographs are be accurate for such measurements. The final clear limitation was having incomplete data, the missing data for 10 sets of patients preoperative angles were in the extramedullary group this

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Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative Tibio-Femoral Angle</td>
<td>EM</td>
<td>51</td>
<td>7.64</td>
<td>7.00</td>
<td>3.50</td>
<td>3.00</td>
<td>17.00</td>
<td>0.781</td>
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<tr>
<td></td>
<td>IM</td>
<td>39</td>
<td>7.17</td>
<td>6.00</td>
<td>3.72</td>
<td>1.00</td>
<td>15.00</td>
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</tr>
<tr>
<td>Post Operative Tibio-Femoral Angle</td>
<td>EM</td>
<td>51</td>
<td>2.90</td>
<td>3.00</td>
<td>1.55</td>
<td>1.00</td>
<td>6.00</td>
<td>0.829</td>
</tr>
<tr>
<td></td>
<td>IM</td>
<td>49</td>
<td>2.77</td>
<td>2.00</td>
<td>1.31</td>
<td>1.00</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>Post Operative Tibial Tangent Angle</td>
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<td>87.45</td>
<td>88.00</td>
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<td>84.00</td>
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<tr>
<td></td>
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<td>87.98</td>
<td>88.00</td>
<td>1.66</td>
<td>85.00</td>
<td>91.00</td>
<td></td>
</tr>
</tbody>
</table>

Descriptive Statistics.  N = Number participants SD = Standard Deviation
could have had an influence on the before surgery group comparisons.

The theoretical advantages and disadvantages of both intramedullary and extramedullary methods are well documented in the literature [5]. The intramedullary method cannot be accurately used in patients who have a history of skeletal trauma and subsequent deformity, neither can the intramedullary method be reliably used in those with retained metal work or used on those with significant natural bowing of the tibia. The intramedullary method also can compromise the effectiveness of the press-fit cementing technique, this is due to the relatively large space that is made on the tibial surface connecting with the medullary canal. Some surgeons opt to plug the space in order to strengthen the tibial platform. The extramedullary technique has also been criticised because of the inaccuracies with the surgeon estimating or ‘eyeballing’ where the centre of the tibial axis should be. It is also highly unreliable in obese patients where the centre of the talus is difficult to locate. Of note Lorenzo et al. [6] did not find obesity an issue and instead reported a reduced surgical time with intramedullary techniques as the tibial centre is found more readily.

The Debate between intramedullary and extramedullary tibial cutting Jigs/guides/ devices continues and most orthopaedic surgeons will use their own preferred technique and will continue to achieve good post operative results as we have found in our centre. Our study is rare due to the fact we have a single surgeon performing both techniques therefore controlling for any surgical experience or operating technique differences. The post operative radiographs were also reviewed at the 1st outpatient clinic appointment, thus patient demographics are also controlled. This method ensures any differences in patient weight, rehabilitation or bone quality should not have any influence on the 1st post op film, thus focussing on the operative technique only. The study has also blinded the 1st researcher improving the validity and reducing any possible observer bias. We have found no significant difference between the intramedullary method for TKR tibial alignment and the extramedullary method, and would advocate Orthopaedic surgeons should remain at liberty to utilise their most familiar tibial alignment cutting technique, either an intra or extramedullary method, this is in keeping with similar studies in the literature [7, 8].

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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Declared none.

REFERENCES