Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jcot

Technical Note

Reliable and reproducible technique to mark center of ankle in total knee arthroplasty[☆]

Anshul Sobti D.Ortho, D.N.B Ortho^a, Shriji Maniar D.N.B Ortho^b,
Sameer Chaudhari MS Ortho^c, Vivek Shetty M.S Ortho, MCh. Ortho^{d,*}

^a Associate Consultant in Orthopaedics, Department of Orthopaedics, P.D Hinduja National Hospital and Medical Research Centre, Veer Savarkar Marg, Mahim, Mumbai, 400016, India

^b Consultant in Orthopaedics, Maniar Clinic, 5/D-3 Khira Nagar, S.V. Road, Santa Cruz West, Mumbai, 400054, India

^c Fellow in Trauma & Arthroplasty, P.D Hinduja National Hospital and Medical Research Centre, Veer Savarkar Marg, Mahim, Mumbai, 400016, India

^d Consultant in Orthopaedics Trauma & Arthroplasty, P.D Hinduja National Hospital and Medical Research Centre, Veer Savarkar Marg Mahim, Mumbai, 400016, India

ARTICLE INFO

Article history:

Received 17 January 2015

Accepted 17 February 2015

Available online 19 March 2015

Keywords:

ECG lead

Centre of ankle

Extramedullary guide

TKA

ABSTRACT

Aim: Bony and soft tissue landmarks have been used in the past to determine the center of the ankle to facilitate the tibial cut using an extramedullary guide in total knee arthroplasty. However literature reports are scanty in regards to the most ideal method available and its reproducibility in marking the center of the ankle intra-operatively.

Methods: We describe a method of using an electrocardiogram (ECG) lead in determining the center of the ankle, thus facilitating the alignment of the extramedullary guide for the tibia. **Results:** Using this technique, in our study the mean lateral tibial component angle was 90.09(84.2°–94.3°). The number of knees in the range of 88°–92.4° were 120 out of 122 knees (98.40%).

Conclusion: The described method is reliable and cheap, with reproducibility in determining the tibial cut in total knee arthroplasty.

Copyright © 2015, Delhi Orthopaedic Association. All rights reserved.

1. Introduction

Long-term success of total knee arthroplasty (TKA) is hinged on good alignment of the components and alignment of the limb. Several studies have shown a significant correlation

between favorable clinical outcome and radiographic alignment.¹ Intramedullary guides are commonly used and have taken precedence for femoral alignment. For tibial alignment either an extramedullary or an intramedullary guide is used. Out of the two the intramedullary one has been considered

[☆] Work done at: Department of Orthopaedics, P.D Hinduja National Hospital and Medical Research Centre, Mahim, Mumbai.

* Corresponding author. Department of Orthopaedics, P.D Hinduja National Hospital and Medical Research Centre, Veer Savarkar Marg, Mahim, Mumbai 400016, India. Fax: +91 (0) 2224440425.

E-mail address: vivshetty1984@gmail.com (V. Shetty).

<http://dx.doi.org/10.1016/j.jcot.2015.02.001>

0976-5662/Copyright © 2015, Delhi Orthopaedic Association. All rights reserved.

superior for making the tibial cuts and arriving at an accurate placement of the components by many authors.² Extramedullary guides have been found to be unreliable with abnormal ankle anatomy and in obese individuals where bony landmarks are difficult to palpate.

Surgeons favoring extramedullary guides argue that the tibial tuberosity, tibial crest and ankle joint are easily palpable and thus help in guide placement.³ The extramedullary guide is aligned along the long axis of the tibia and centered at the midpoint of the talus.⁴ Various methods are described to mark the centre of the talus ranging from palpating the two malleoli, using the second metatarsal as a landmark, lateral border of extensor hallucis longus (EHL) tendon at the joint,⁵ 3–5 mm medial to the malleolar centre,⁶ however there ceases to exist a consensus on the most ideal method. We describe a method of marking the center of the ankle with an electrocardiogram (ECG) lead, using an image intensifier.

2. Technique

Preoperatively, in the operating room, an ankle radiograph (mortise view) is taken on an image intensifier with an ECG lead at the centre of the talus (Fig. 1). After radiographic confirmation the ECG lead is covered with an adhesive transparent film dressing (3M Tegaderm) (Fig. 2). Post application of the adhesive transparent film dressing another ankle mortise radiograph is taken to reconfirm the position of the lead. The procedure of marking the ankle with ECG lead takes about 1 min and exposure amounts to 0.1 to 0.3 Roentgen (R). The leg is then painted and draped. The foot is covered with a transparent sterile plastic cling wrap after attaching it to a foot holder (Fig. 3). The metal tip of the ECG lead makes it easy to palpate intra operatively.

Fig. 1 – Ankle mortise view on image intensifier with ECG lead marking the centre of the ankle.

Fig. 2 – ECG lead position after application of the adhesive transparent dressing.

The extramedullary guide for tibia is aligned with the tibial spine, the medial one third of the tuberosity and the ECG lead (centre of the ankle). Furthermore, during the surgery the position of the tibial cutting guide is reconfirmed with the alignment rod matching the ECG lead (Fig. 4). A total of 122 knees in which ECG lead was used to mark the centre of the ankle, were subjected to a post-operative scanogram (at 3 months). The Lateral tibial component angle angle was measured using the PACS (IMPAX 6.5.1.1008) on the scanogram.

3. Discussion

Alignment has been the keystone for a successful TKA. Failure rate rises when the tibial implants are placed in varus or valgus.¹ In valgus deformities,⁷ severe tibial bowing⁸ and residual deformity after osteotomy, intramedullary systems do not ensure correct tibial cuts, justifying the use of extramedullary guides. Furthermore, extramedullary guides avoid the potential complications of intra-medullary guide use, including fat embolization and hypoxia and intra-operative fracture.⁹ However an accurate and consistent positioning of the extramedullary guides is difficult. Dalury describes guidelines for proximal positioning at the tibial tubercle that achieves appropriate alignment. He recommends a line drawn 1 mm medial to the medial edge of the tibial tubercle and passing through the mid-sulcus of the tibial spines.¹⁰

Fig. 3 – After draping with the ECG lead.

Distally various landmarks for the alignment of extra medullary guide to the centre of the ankle, have been described by authors. Given the large number of methods available there exists an inter-observer and intra-observer variability. Our results suggests that using an ECG lead as a marker, after confirmation on the image intensifier, and palpating it intra-operatively as the centre of ankle gives a

Fig. 4 – Aligning the alignment rod with the ECG lead.

satisfactory alignment of the limb. Even in obese individuals, patients with gross coronal deformities and foot deformities this technique reproduces a consistent tibial cut.

In our study the mean lateral tibial component angle was $90.09(84.2^{\circ}-94.3^{\circ})$. The number of knees in the range of $88^{\circ}-92.4^{\circ}$ were 120 out of 122 knees (98.40%).

A limitation of the technique is the subjective assessment in alignment of the tibial cutting guide with the ECG lead. However, in view of a consistent reproducibility of the lateral tibial component angle as well as the mechanical angle, this technique is worth recommending. The authors recommend this convenient, easy, reliable and cheap method for the reproducibility of the tibial cut.

Conflicts of interest

All authors have none to declare.

Authors contribution

VS conceptualized the method and implemented it. SM, AS and SC analyzed and interpreted the patient data. AS, VS, SM made major contributions in writing the manuscript. All authors read and approved the final manuscript.

REFERENCES

1. Lotke PA, Ecker ML. Influence of positioning of prosthesis in total knee replacement. *J Bone Joint Surg Am.* 1977 Jan;59:77–79.
2. Bono JV, Roger DJ, Laskin RS, Peterson MG, Paulsen CA. Tibial intramedullary alignment in total knee arthroplasty. *Am J Knee Surg.* 1995;8:7–11. discussion11–2.
3. Dorr LD, Merkel C, Mellman MF, Klein I. Fat emboli in bilateral total knee arthroplasty. Predictive factors for neurologic manifestations. *Clin Orthop Relat Res.* 1989 Nov;248:112–118. discussion118–9.
4. Moreland JR. Mechanisms of failure in total knee arthroplasty. *Clin Orthop Relat Res.* 1988 Jan;226:49–64.
5. Schneider M, Heisel C, Aldinger PR, Breusch SJ. Use of palpable tendons for extramedullary tibial alignment in total knee arthroplasty. *J Arthroplasty.* 2007 Feb;22:219–226.
6. Maestro A, Harwin SF, Sandoval MG, Vaquero DH, Murcia A. Influence of intramedullary versus extramedullary alignment guides on final total knee arthroplasty component position: a radiographic analysis. *J Arthroplasty.* 1998 Aug;13:552–558.
7. Simmons EDJ, Sullivan JA, Rackemann S, Scott RD. The accuracy of tibial intramedullary alignment devices in total knee arthroplasty. *J Arthroplasty.* 1991 Mar;6:45–50.
8. Teter KE, Bregman D, Colwell CWJ. Accuracy of intramedullary versus extramedullary tibial alignment cutting systems in total knee arthroplasty. *Clin Orthop Relat Res.* 1995 Dec;321:106–110.
9. Dennis DA, Channer M, Susman MH, Stringer EA. Intramedullary versus extramedullary tibial alignment systems in total knee arthroplasty. *J Arthroplasty.* 1993 Feb;8:43–47.
10. Dalury DF. Observations of the proximal tibia in total knee arthroplasty. *Clin Orthop Relat Res.* 2001 Aug;389:150–155.