The Knee xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

The Knee

Review

How accurately does high tibial osteotomy correct the mechanical axis of an arthritic varus knee? A systematic review

Maxim Van den Bempt [a,b,*], Wouter Van Genechten [a,b], Toon Claes [c], Steven Claes [c,d]

[a] Hasselt University, Hasselt, Belgium
[b] University of Antwerp, Antwerp, Belgium
[c] AZH Hospital, Herentals, Belgium
[d] University Hospitals, Leuven, Belgium

ARTICLE INFO

Article history:
Received 20 January 2016
Received in revised form 9 September 2016
Accepted 5 October 2016
Available online xxxx

Keywords:
Knee
Tibia
Osteotomy
Planning
Accuracy

ABSTRACT

Background: The aim of this study was to give an overview of the accuracy of coronal limb alignment correction after high tibial osteotomy (HTO) for the arthritic varus knee by performing a systematic review of the literature.

Methods: The databases PubMed, MEDLINE and Cochrane Library were screened for relevant articles. Only prospective clinical studies with the accuracy of alignment correction by performing HTO as primary or secondary objective were included.

Results: Fifteen studies were included in this systematic review and were subdivided in 23 cohorts. A total of 966 procedures were considered. Nine cohorts used computer navigation during HTO and the other 14 cohorts used a conventional method. In seven computer navigation cohorts, at least 75% of the study population fell into the accepted "range of accuracy" (AR) as proposed by the different studies, but only six out of 14 conventional cohorts reached this percentage. Four out of eight conventional cohorts that provided data on under- and overcorrection, had a tendency to undercorrection.

Conclusions: The accuracy of coronal alignment corrections using conventional HTO falls short. The number of procedures outside the proposed AR is surprising and exposes a critical concern for modern HTO. Computer navigation might improve the accuracy of correction, but its use is not widespread among orthopedic surgeons. Although HTO procedures have been shown to be successful in the treatment of unicompartmental knee arthritis when performed accurately, the results of this review stress the importance of ongoing efforts in order to improve correction accuracy in modern HTO.

Contents

* Corresponding author at: Hasselt University, Hasselt, Belgium.
E-mail address: maximvandenbempt@live.be (M. Van den Bempt).

http://dx.doi.org/10.1016/j.knee.2016.10.001
0968-0160/

1. Introduction

Numerous studies have shown that accuracy of correction relative to preoperative planning is the most important factor determining a successful high tibial osteotomy (HTO) outcome [1–4]. Small deviations in mechanical femorotibial alignment (mFTA) cause large changes in load distribution over the knee joint that can lead to further cartilage degeneration and dysfunction [5–7]. In a biomechanical study, Hsu et al. [6] showed that the medial compartment of the knee bears 75% of bodyweight in a knee with a mFTA of one degree varus alignment. With a mFTA in six degrees of varus alignment, the medial surface has to bear up to 90% of bodyweight [6].

According to Gebhard et al. [8], the ideal axis correction is difficult to obtain and postoperative under- and overcorrection regularly occurs after HTO. These mistakes are possibly due to traditional perioperative measurement techniques that have shown both low reproducibility and intra-observer variability, incorrect radiologic measurement and unstable fixation methods [5,7,9,10].

The primary objective of this review was to give an overview of the surgical accuracy of coronal limb alignment correction after HTO in the arthritic varus knee. Secondly, this study aimed to provide guidance regarding an optimal accepted accuracy range (AR; a proposed range in which the correction of the alignment is defined as successful) [11].

2. Methods

This systematic review reports in accordance with the recommendations proposed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [12].

2.1. Search strategy

This systematic review was carried out by identifying all studies related to the accuracy of coronal axis correction by HTO. The MEDLINE database was screened using PubMed. Studies published prior to 1 February 2016 were considered for inclusion in this systematic review. The sole search term 'high tibial osteotomy' was used in the database. One additional record was identified through other sources.

2.2. Study selection

The following exclusion criteria were applied to the articles: (1) non-English literature; (2) studies performed on non- living subjects (examples include biomechanical studies, cadaver studies and computer simulations), defined as ex vivo studies; (3) articles in which standard-procedure HTO, with the indication osteoarthritis and/or genu varum, was not the main objective; (4) case reports (less than 10 knees in the study), criticisms, replies to other publications; (5) articles published prior to 1991; (6) retrospective studies; and (7) studies in which data on the accuracy of HTO was unavailable. The remaining articles were included in this systematic review.

2.3. Data extraction

Each study was evaluated for the following variables: type of study, population size, indication of surgery, degree of osteoarthritis, preoperative mFTA (including standard deviation and range), targeted angle (TA), accepted AR, postoperative mFTA (including standard deviation and range), type of HTO open-wedge osteotomy (OWO)/closed-wedge osteotomy (CWO), perioperative measuring method for the axis correction, percentage of accurate corrections inside the proposed AR, percentage of under- and overcorrections outside the AR and follow-up time interval. All data were extracted independently by two reviewers to avoid missing any data. Any discrepancy between the datasets from the two reviewers was double checked to avoid other possible errors in the process of data extraction. Finally, the quality of evidence for each outcome was rated following the Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) Working Group system [13].

Please cite this article as: Van den Bempt M, et al, How accurately does high tibial osteotomy correct the mechanical axis of an arthritic varus knee? A systematic review, Knee (2016), http://dx.doi.org/10.1016/j.knee.2016.10.001