

# High Tibial Osteotomy Scientific Update

First introduced by Jackson and Waugh in 1961, high tibial osteotomy (HTO) became popular as a treatment modality for medial compartment osteoarthritis of the knee with varus deformity.<sup>1</sup> Revolutionary improvements of implants and techniques have occurred during the past decade, including most recently the introduction of the iBalance® HTO system.

Hohmann E,  
Tetsworth K,  
Glatt V,  
Ngcelwane M,  
Keough N

## Surgical Technique

[Increased posterior slope of the medial and lateral meniscus posterior horn is associated with anterior cruciate ligament injuries.](#) *Arthroscopy.* 2022;38(1):109-118. doi:10.1016/j.arthro.2021.04.066

- Purpose of the study was to measure the slope of the medial and lateral posterior horn of the meniscus and its contribution to the resulting posterior tibial slope.
- The results of this study strongly suggest that lower meniscal slopes of both the medial and lateral posterior horns are associated with ACL injuries in both males and females.

## Takeaway

The findings of this study further support an association between both medial and lateral tibial posterior slope with ACL injury.

Cantivalli A,  
Rosso F,  
Bonasia DE,  
Rossi R

[High tibial osteotomy and anterior cruciate ligament reconstruction/revision.](#) *Clin Sports Med.* 2019;38(3):417-433. doi:10.1016/j.csm.2019.02.008

- The aim of this article is to summarize the most recent literature about the indication, preoperative planning, surgical technique, and outcomes of HTO performed in association with anterior cruciate ligament (ACL) reconstruction and revision.

## Takeaway

A combined HTO and ACL reconstruction or revision may be a viable option in young patients affected by anterior instability and medial osteoarthritis (OA) with good midterm outcomes if the correct indication, preoperative planning, and surgical technique are applied.

Herman BV,  
Giffin JR

#### [High tibial osteotomy in the ACL-deficient knee with medial compartment osteoarthritis.](#)

*J Orthop Traumatol.* 2016;17(3):277-285. doi:10.1007/s10195-016-0413-z

- Anterior cruciate ligament (ACL) insufficiency may lead to post-traumatic arthritis due to altered joint loading and associated injuries to the menisci and articular cartilage.
- Understanding the importance of posterior tibial slope and its role in sagittal knee stability has led to the development of biplanar osteotomies designed to flatten the posterior tibial slope in the ACL deficient knee.
- Decreasing posterior tibial slope has the ability to improve stability with or without the need for a ligament reconstruction.

#### **Takeaway**

High tibial osteotomy is an effective procedure in the surgical management of symptomatic, varus-malaligned patients with an ACL deficiency.

Bonnin M,  
Selmi TAS,  
Shepherd D

[Sports and high tibial osteotomy.](#) In: Doral MN, Karlsson J, eds. *Sports Injuries.* Springer, Berlin, Heidelberg; 2015:2451-2459.

- The possibility to return to sporting activity is an important consideration in the decision-making process in femorotibial OA in young patients.
- In a cohort of active patients following an HTO procedure, 66% of active patients who received an HTO returned to a least one impact sport.

#### **Takeaway**

Given the excellent survival rates of HTO and the potential risks of wear, loosening, or periprosthetic fractures related to sports activity with the use of a prosthesis, it is reasonable to prefer HTO in patients with suitable inclusion criteria.

Thompson KA,  
Darden CN,  
Katsman A,  
Alaia MJ,  
Strauss EJ,  
Jazrawi LM

#### **iBalance® HTO Implant**

[Short-term clinical outcomes of high tibial osteotomy with the iBalance HTO system.](#)

*Bull Hosp Jt Dis* (2013). 2019;77(4):256-262

- The purpose of this study was to evaluate short-term outcomes in patients who underwent an opening wedge high tibial osteotomy with the iBalance HTO system.

#### **Takeaway**

The iBalance medial opening wedge HTO system has been shown to be safe without many of the complications experienced with other osteotomy implant options.

Roberson TA,  
Momaya AM,  
Adams K,  
Long CD,  
Tokish JM,  
Wyland DJ

[High tibial osteotomy performed with all-PEEK implants demonstrates similar outcomes but less hardware removal at minimum 2-year follow-up compared with metal plates.](#) *Orthop J Sports Med.* 2018;6(3):2325967117749584. doi:10.1177/2325967117749584

- This study compared patient outcomes and complications of HTO performed using a traditional metal plate with those performed using an all-PEEK implant.

#### **Takeaway**

This study suggests that an all-PEEK implant may be safely used with outcomes and complication rates comparable to the traditional method but with less need for hardware removal.



Ghinelli D,  
Parma A,  
Baldassarri M,  
et al

[High tibial osteotomy for the treatment of medial osteoarthritis of the knee with new iBalance system: 2 years of follow-up. \*Eur J Orthop Surg Traumatol.\* 2016;26\(5\):523-535. doi:10.1007/s00590-016-1768-9](#)

- The aim of this study was to determine the short-term outcomes of the iBalance® technique in medial compartment OA and varus malalignment of the knee.
- iBalance technique proved to be effective and safe and produced good overall results.

#### **Takeaway**

Consolidation and osseointegration of the system took place rapidly, while recovery was precocious, comparable with traditional methods and with no severe complications.

### **Biologic Augmentation**

[Structural allograft impaction enables fast rehabilitation in opening-wedge high tibial osteotomy: a consecutive case series with one year follow-up. \*Knee Surg Sports Traumatol Arthrosc.\* 2020;28\(12\):3747-3757. doi:10.1007/s00167-019-05765-z](#)

- Purpose of the study was to investigate the effect of press-fit structural impacted bone allograft with locking plate fixation in opening wedge HTO.
- One-year postoperative follow-up was performed on 103 patients who had undergone an opening wedge HTO.

#### **Takeaway**

Study demonstrated that adding bone allograft in an HTO leads to low postoperative pain levels, early mobility, and excellent short-term clinical outcomes.

Van Genechten W,  
Van den Bempt M,  
Van Tilborg W,  
et al

Scordino LE,  
Obopilwe E,  
Charette R,  
Edgar CM,  
DeBerardino TM,  
Mazzocca AD

[Calcium phosphate cement enhances the torsional strength and stiffness of high tibial osteotomies. \*Knee Surg Sports Traumatol Arthrosc.\* 2017;25\(3\):817-822. doi:10.1007/s00167-015-3692-7](#)

- This paper investigated the effect of injectable calcium phosphate cement on the biomechanical stability of a standard high tibial osteotomy defect with applied torsional load and ultimate stiffness of the supporting construct.
- The study compared the load of failure and mechanism of failure in torsion between PEEK wedge implants with and without calcium phosphate bone cement to a titanium plate.

#### **Takeaway**

The most important finding in this study is that the addition of calcium phosphate bone cement to opening wedge osteotomy fixation significantly increased load to failure in torsion.



Takeuchi R,  
Woon-Hwa J,  
Ishikawa H,  
et al

[Primary stability of different plate positions and the role of bone substitute in open wedge high tibial osteotomy.](#) *Knee.* 2017;24(6):1299-1306. doi:10.1016/j.knee.2017.07.015

- This study compared the mechanical fixation strengths of anteromedial and medial plate positions and the effects of bone substitute placement into the osteotomy site.
- Twenty-eight sawbone tibias were tested.

#### **Takeaway**

Medial plate positioning was biomechanically superior and bone substitute distributed the stress concentration around the osteotomy gap and prevented an increase in posterior tibial slope.

#### **Reference**

1. Lee DC, Byun SJ. High tibial osteotomy. *Knee Surg Relat Res.* 2012;24(2):61-69. doi:10.5792/ksrr.2012.24.2.61