

**Factors Associated With The Discrepancy
Between Preoperative Plan And
Postoperative Alignment In Closed Wedge
High Tibial Osteotomy**

**Hyuksoo Han, Seong Hwan Kim, In Woong Park, Kee Yun
Chung, Ki Bum Kim, Sahnghoon Lee, Sang Cheol Seong,
Myung Chul Lee**

Department of Orthopaedic Surgery

Seoul National University College of Medicine



Disclosure

- All authors of this study have no financial conflicts to disclosure



Introduction

- **Differences between preoperative planning and postoperative axis in HTO**
 - **weight-bearing status in postoperative radiograph**
 - **supine position in operation**

Dugdale CORR 1992 Bonnin Orthopade 2004

Huang CORR 2005 Schroter KSSTA 2013 Sim JA KSSTA 2010



Introduction

- Causes of overcorrection compared with planning
 - 1° overcorrection with 1mm of lateral joint width

Dugdale CORR 1992

- 1.38 ° overcorrection with 1° of MPTA change

Terauchi CORR 1995

- 2° of LDFA as a cut off value

Rudan Can J Surg 1999

- 1.7° overcorrection with weight bearing

Sim JA KSSTA 2010 Specogna AJSM 2007



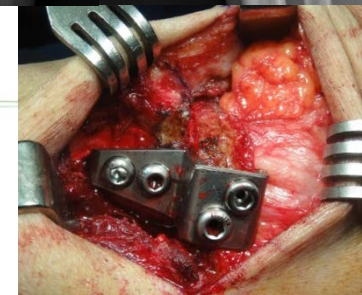
Purpose

- **To find the predictable measurements in weight bearing radiograph and demographic data for the postoperative overcorrection compared with planning angle**



Materials and Methods

- Retrospective study : 135 cases of CW-HTO
- Demographic data
 - Age (mean \pm SD) : 50.1 \pm 9.3
 - BMI (mean \pm SD) : 25.0 \pm 2.8
 - K-L grade (mean \pm SD) : 1.5 \pm 0.7
 - Male/Female : 41/94
- Surgical Technique
 - Rigid stepped plate was used



Materials and Methods

- Radiologic analysis

mTFA	Mechanical tibiofemoral angle
mLDFA	Mechanical lateral distal femur angle
MPTA	(Mechanical) medial proximal tibia angle
JLCA	Joint line convergence angle
JSW	Joint space width
DJSW	discrepancy of medio-lateral joint space width
cTFA	change of mechanical femorotibial angle from preoperative to postoperative(real changed angle)
cMPTA	change of mechanical medial proximal tibial angle from preoperative to postoperative(planning angle)



Results

- Radiologic analysis

	Preoperative			Postoperative			P value
	Mean	SD	95% CI	Mean	SD	95% CI	
mTFA	8.304	3.734	7.674 ~ 8.933	-3.052	2.585	-3.488 ~ -2.615	0.000
MPTA	6.185	3.126	5.657 ~ 6.712	-3.687	2.99	-4.191 ~ -3.182	0.000
Med. JSW	2.99	1.245	2.779 ~ 3.2	3.667	1.249	3.456 ~ 3.877	0.000
Lat. JSW	6.053	1.453	5.807 ~ 6.298	5.551	1.436	5.308 ~ 5.793	0.000
DJSW	3.062	1.802	2.758 ~ 3.365	1.883	1.397	1.647 ~ 2.118	0.000

	Mean change	SD	95% CI(Lower,Upper)
cTFA	11.346	4.402	10.603,12.088
cMPTA	9.872	4.12	9.176,10.567
cTFA - cMPTA	1.474	2.285	1.088,1.859



Results

- Regression analysis

Factor	Mean discrepancy between cTFA and cMPTA		
	$\beta \pm SE$	P-value	R ²
Univariate analysis¶			
1. mTFA	0.131 ± 0.058	0.053	0.046
2. MPTA	-0.138 ± 0.069	0.059	0.036
3. Medial JSW	-1.016 ± 0.148	0.079	0.037
4. Lateral JSW	0.339 ± 0.148	0.054	0.046
5. DJSW	0.706 ± 0.102	0.000	0.310
6. mLDEFA	0.179 ± 0.097	0.067	0.031
7. JLCA	0.798 ± 0.095	0.000	0.396
8. Age	0.034 ± 0.024	0.152	0.019
9. BMI	0.198 ± 0.077	0.081	0.058
10. K-L grade	1.027 ± 0.287	0.001	0.107
11. Gender	0.422 ± 0.502	0.402	0.007
Multivariate analysis¶			Adjusted R ²
DJSW	0.077 ± 0.199	0.7	0.462
JLCA	0.77 ± 0.196	0.000	
K-L grade	-0.169 ± 0.297	0.57	

Results

- **By the equation, 1° of valgus overcorrection**
 - every 2.5° of joint line convergence angle
 - every 2.4 mm of medio-lateral joint width discrepancy
 - one grade of K-L grading
- **In multivariate model with enter analysis, those combination of factors could have 46.2% power of explanation.**



Limitations

- **Retrospective analysis**
- **Only included closed wedge HTO**
- **Lack of evaluation for soft tissue, such as medial collateral ligament**
- **Lack of analysis in change of mechanical axis during follow up**
- **Only single surgeon's experience**



Conclusion

- The **1.5° valgus overcorrection** of mechanical femorotibial axis angle, as defined ‘real change angle’ was found compared with ‘planning angle’ in tibia.
 - By the equation,
 - **every 2.5°** of joint line convergence angle
 - **every 2.4mm** of medio-lateral joint width discrepancy
 - **one grade** of K-L grading
- 1° of valgus overcorrection in CW HTO



References

- Bonnin M, Chambat P. [Current status of valgus angle, tibial head closing wedge osteotomy in media gonarthrosis]. *Orthopade*. 2004;33(2):135-42.
- Dugdale TW, Noyes FR, Styer D. Preoperative planning for high tibial osteotomy. The effect of lateral tibiofemoral separation and tibiofemoral length. *Clin Orthop Relat Res*. 1992(274):248-64.
- Huang TL, Tseng KF, Chen WM, Lin RM, Wu JJ, Chen TH. Preoperative tibiofemoral angle predicts survival of proximal tibia osteotomy. *Clin Orthop Relat Res*. 2005(432):188-95.
- Rudan J, Harrison M, Simurda MA. Optimizing femorotibial alignment in high tibial osteotomy. *Can J Surg*. 1999;42(5):366-70.
- Schroter S, Ihle C, Mueller J, Lobenhoffer P, Stockle U, van Heerwaarden R. Digital planning of high tibial osteotomy. Interrater reliability by using two different software. *Knee Surg Sports Traumatol Arthrosc*. 2013;21(1):189-96.
- Sim JA, Kwak JH, Yang SH, Choi ES, Lee BK. Effect of weight-bearing on the alignment after open wedge high tibial osteotomy. *Knee Surg Sports Traumatol Arthrosc*. 2010;18(7):874-8.
- Specogna AV, Birmingham TB, Hunt MA, Jones IC, Jenkyn TR, Fowler PJ, et al. Radiographic measures of knee alignment in patients with varus gonarthrosis: effect of weight bearing status and associations with dynamic joint Terauchi M, Shirakura K, Kobuna Y, Fukasawa N. Axial parameters affecting lower limb alignment after high tibial osteotomy. *Clin Orthop Relat Res*. 1995(317):14

