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## 3-D Computed Tomography Scan Evaluation Of Central Femoral ACL Footprint In Different Rotations

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## Summary:

The clinical relevance of this study is related to mismatches that may occur if not well-designed and validated 3D CT scan protocols are used to measure anatomical landmarks and femoral tunnel positioning. Clinical or biomechanical studies may show inaccurate relationship between functional outcomes and ACL tunnel positioning if a standardized neutral CT scan is not utilized.

## Abstract:

Introduction: 3D Computed Tomography (CT) scan is the gold standard method to evaluate native anatomy of the knee and anatomic femoral tunnel positioning after ACL reconstruction. Despite well-described 3D CT scan measurement protocols, this study points out some interesting methodological issues that may contribute to measurement accuracy of ACL positioning. Therefore, the purpose of this study was to validate intra and interclasses measures of a new bony transparency 3D CT scan protocol and investigate central ACL footprint position in different axial rotations in both vertical and horizontal axes.

Methods: We conducted an evaluation of 20 unilateral knee CT scans of different patients available in our CT database (iSite – Philips). Ages ranged between 17 and 43 years old. We used OsiriX Imaging Software (v.3.9.4) in our evaluation. ACL position was set as the central point of femoral footprint below lateral intercondylar ridge. Height (h'/H) and length (t'/T) of central femoral footprint was analyzed according to Bernard & Hertel method. Neutral position was set as posterior and inferior condyles superposition on axial, sagittal and coronal planes. We made rotations on vertical and horizontal axis: -20, -10, 0, +10 and +20 degrees. Statistical analysis: power of study = 80%, ICC, ANOVA, p<0.05 (SPSS-19 for windows).

Results: Bony transparency 3D CT scan showed high reliability of intra-observer (h'/H = 0.941; t'/T = 0.928, p<0.001) and inter-observer (h'/H = 0.921; t'/T = 0.890, p<0.001) Intraclass Correlation Coefficient (ICC). Descriptive analysis – True sagittal view: h'/H = 36%+-10% (mean+-sd); t'/T = 21%+-4% (mean+-sd). Length (t'/T) internal and external rotation (p=0.88 and p=0.03, respectively – ANOVA) and adduction and abduction (p<0.001 and p=0.04, respectively – ANOVA); Height (h'/H) internal and external rotation (p=0.01 and p=0.97, respectively – ANOVA) and adduction and abduction (p=0.79 and p=0.65, respectively – ANOVA)

Discussion and Conclusion: This present study contributes to improve the accuracy of femoral tunnel positioning measurement. Bony transparency 3D CT protocol uses the entire intercondylar roof to calculate Blumensaat line. This issue is technically important because Blumensaat line is a superposition image and some ACL measurement protocols depends on it, and this relationship is not linear. Both posterior and inferior condyles wall were aligned at this study, with control of "varus" and "valgus" rotation either. This 3D CT scan protocol has high reliability and small rotation degrees (50) close to "true lateral view" do not change central ACL position measurement