

# Traditional sequential medial soft tissue release may not be the best sequence for balancing in total knee arthroplasty for varus knees

DEEP K<sup>1</sup>, DUFFY S<sup>2</sup>, FREER I<sup>3</sup>, GOUDIE S<sup>1</sup>, NALWAD H<sup>1</sup>, DEAKIN A<sup>1</sup>, PAYNE A<sup>2</sup>

<sup>1</sup>Department of Orthopaedics, Golden Jubilee National Hospital, Glasgow, UK

<sup>2</sup>Department of Anatomy, University of Glasgow, UK

<sup>3</sup>Assisting Fellow, BBraun Aesculap, UK

mrkdeep@gmail.com

**Introduction:** Soft tissue balancing is an important aspect of total knee replacement surgery. Traditionally sequential medial soft tissue release is performed for balancing in varus deformity. Its effects on kinematics and dynamic Femoro-Tibial-Mechanical-Angle (FTMA) have been described in extension and 90° flexion in coronal plane. However most studies have missed what happens when the knee flexes from 0 to 90 degrees This study is one of the first to describe its effects on knee kinematics throughout flexion. The aim was to look at deviation of FTMA in coronal plane with traditional sequential medial release with and without measured stress applied in varus and valgus at each point of measurement through the range of flexion.

**Methods:** 12 cadaveric knees were studied using a computer navigation system. Rigid bodies were fixed to femur and tibia. The knee was exposed as per doing TKR surgery with medial parapatellar approach with no disturbance to the collateral ligaments. The anatomy was registered using an infra red waves based passive tracker navigation system. FTMA was studied in extension, 0°, 5°, 30°, 45°, 60°, 90° and maximum flexion. Sequential medial release was performed in 7 steps as described by Luring et al(Ref1). The sequential steps were Step 1: 2 cm release (antero medial tibial sleeve), Step 2: Postero-medial release, Step 3: 4cm medial sleeve release, Step 4: 6cm medial sleeve release, Step 5: Deep medial collateral ligament, Step 6: posterior cruciate ligament (PCL) medial half only, Step 7: entire PCL.

At each step FTMA was measured with and without stressing at each point of flexion. A 10 Newton Meter moment arm was applied for varus and valgus stress force.

**Results:** Most of the initial release steps had little effect on FTMA without force application, especially in the initial 60° of flexion.

Application of varus force demonstrated very small changes at all points of flexion.

Application of valgus force demonstrated little change in initial arc of flexion until step 5 was reached.

Limb Position	Step1	Step2	Step3	Step4	Step5	Step6	Step7
Hyperextension	-0.1	0.2	0.1	0.4	0.7	1.7	4.4
0°Flexion	-0.1	0.6	0.6	0.6	2.5	3.5	6.6
15°Flexion	-0.3	0.4	0.6	1.4	3.8	5.3	8.8
30°Flexion	0.6	1.2	1.5	2	5.8	8.5	11
45°Flexion	0.8	1.3	1.6	2.3	6	10.5	12.2
60°Flexion	0.9	1.3	2.2	3	5.5	11	15.2
90°Flexion	0.1	1.6	1.6	2.3	4.5	12.2	22.4
Maximum Flexion	1.3	3.1	4.5	1.7	5.1	15	24.4

Table 1: Mean change in FTMA with sequential medial release steps with measured valgus force applied at each point of flexion

**Discussion:** For soft tissue balancing until now surgeons have only considered balancing at 0 and 90 degrees. The middle part of the motion has been mostly neglected due to unavailability of any practical measurement devices. Phenomenon of mid flexion instability is not uncommon. Computer navigation has made it possible to monitor the kinematics throughout the range of flexion. The traditional sequential release and balancing methods were designed when there was no insight into middle range of the flexion movement. Now with objective measurement devices being available we need to revisit the techniques. Our study shows that the initial steps of the release make little difference to open the knee in initial range of flexion even with applied valgus stress force. Thus the present sequence of medial release may not be correct and should be further investigated to modify the sequence for soft tissue balancing in TKR surgery.

#### **Reference**

- [1] Luring C et al. The effectiveness of sequential medial soft tissue release on coronal alignment in TKA.J Arthroplasty;2006 Apr: 21(3):428-34.