Introduction:
The Low Contact Stress (LCS) prostheses (Depuy, Warsaw, Indiana) were designed to minimally constrain knee kinematics while minimizing bone-cement-prosthesis interface stresses and polyethylene wear. The kinematics and stability of the knee following arthroplasty with these devices rely on adequate tensioning of the remaining soft tissue by management of the flexion/extension gaps at the time of surgery. The purpose of this study is to evaluate anteroposterior (AP) displacement and abduction and adduction (Abd/Add) direction in both posterior cruciate ligament retaining (PCLR), meniscal bearing and posterior cruciate ligament sacrificing (PCLS) rotating platform mobile bearing total knee arthroplasty (TKA) at 6 month postoperatively in vivo.

Materials and Methods: Fifty-three Low Contact Stress (LCS) prostheses (Depuy, Warsaw, Indiana) were analyzed. All patients were chosen from group with no clinical complication, and all had achieved passive full extension and at least 90° of flexion. PCLR consisted of 29 knees, and mean age was 70 years. The average range of knee motion was 117° ±15° and average HSS Score was 92±2. PCLS consisted of 24 knees, and mean age was 72 years. The average range of knee motion was 119° ±17° and average HSS Score was 90±4. All procedure had been carried out by single surgeon (Y.I) using a standardized technique. Anteroposterior (AP) displacement of the knee was measured at 30° and 90° flexion, Abduction/Adduction (Abd/Add) were measured at between 0° and 20° flexion. Both AP displacement and Abd/Add were measured using a Telos arthrometer (Fa Talos, Medizinisch-Technische GmbH, D-6103 Griesheim, Germany) applying 150 newtons. Total AP displacement was measured because the resting position of the femoral component in relation to the tibial component was variable. The patients was told to relax and standard radiographs were taken after the force had been applied for one minute. One observer (Y.M) performed all of the tests. Measurements were done three times and the average value of the three measurements was used for evaluation. Non-paired or paired t-test was used for statistical analysis.

Results: There were no radiolucent lines of the femoral and the tibial components in the knees with LCS prostheses. Table 1 gives mean total displacement (TD) of 30° flexion and 90° flexion and mean values of magnitudes of abduction and adduction in both PCLR and PCLS group. All values were not significantly statistical different between PCLR and PCLS (p=0.05). In comparison of 30° and 90° flexion, PCLR groups showed significantly different (p=0.0009) but did not PCLS groups (p=0.5815).

Discussion and Conclusion: Although many studies have been reported for the laxity in knee joint, they were concerned about the role of ligaments and soft tissue structures in human knee. Recently the in vivo studies about laxity after TKA are increasing with 3-dimensional knee laxity system, with fluoroscopic analysis. In this present study, Telos arthrometer (Fa Talos, Medizinisch-Technische GmbH, D-6103 Griesheim, Germany) was used to measure AP laxity and coronal stability (abduction and adduction) in patients with the posterior cruciate ligament (PCL) retaining, meniscal bearing and posterior sacrificing rotating platform designs of the LCS prostheses (Depuy, Warsaw, Indiana).

The role of the PCL and the benefits of its preservation in primary total knee arthroplasty (TKA) continue to be a source of controversy. Despite the philosophical differences in design principals, TKA has been clinically and functionally successful whether the PCL has been preserved, sacrificed, or substituted for. Our goal was to analyze the laxity of the LCS PCLR, meniscal bearing design in comparison to that of the PCLS, rotating platform design, to assess the role of the PCL in TKA.

In comparison of abduction and adduction in each group, there were no statistical difference between PCLR and PCLS knees (p=0.9732 in abduction and 0.4062 in adduction). On the other hand, both PCLR and PCLS in TKA showed approximate 4° in both abduction and adduction without significant difference. Taking their good clinical results into account, the laxity approximate 4° might be favorable degree in these direction. Draganich et al reported that TRAC PS mobile bearing prostheses showed 3° abduction and 4° adduction at 20° of flexion with 3-dimensional knee laxity testing system. Their results supported ours. However, further followup period and analysis of another design prostheses were needed to provide this value was consistent.

In AP laxity, PCLR has been expected to contribute to posterior laxity after TKA. There have been reports of AP laxity after TKA, but many studies evaluated this laxity only at early flexion (20° to 30° flexion). The only study with flexion comparable to that of the current study is that of Worland et al, who tested posterior stability of knees 4 years after surgery, and at 80° flexion measured an average 1.6-mm displacement when applying a posterior force of 80 newtons. In the current study, total AP displacement was measured. However, if the tibia already is located posteriorly relative to the femur before the testing, measuring only posterior displacement will underestimate total AP instability. Because it is difficult to determine the neutral AP position of the femoral component on the tibial surface, measurement of the AP displacement was a more reliable evaluation of AP laxity.

In this study, there were no statistical difference between PCLR and PCLS knees (p=0.4123 in 30° flexion and 0.7047 in 90° flexion). On the other hand, in PCLR, AP laxity of the knee was greater at 30° than at 90° flexion with significant difference (p=0.0009). Matsuda S et al [1] reported that in a kinematic study of a a anaomic specimen knees with and without a posterior cruciate ligament, AP laxity of the knee was greater at 30° than at 75° flexion with an intact PCL, but with an absent PCL, AP laxity of the knee was greater at 75° flexion. Their results supported ours and in this study, PCLR knees had a good functional PCL.

Considering that all patients in this study have good clinical results, approximate 10mm in AP displacement and around 4° laxity in coronal directions were considered as favorable laxity in LCS mobile bearing prostheses both PCLR and PCLS designs. The results suggested that in obtaining the adequate central stability and coronal of the flexion and extension gap stability, spherically congruent surfaces allows suitable laxity, and which lead to achieving a successful TKA whether PCL retain or not.

Table 1: AP displacement and Abd/add direction

<table>
<thead>
<tr>
<th>AVG±1SD</th>
<th>30° TD(mm)</th>
<th>90° TD</th>
<th>Abduction</th>
<th>Adduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCLRn=29</td>
<td>10.8±2.7</td>
<td>9.4±2.7</td>
<td>3.7°±1.6</td>
<td>3.6°±1.2</td>
</tr>
<tr>
<td>PCLSn=24</td>
<td>10.0±3.3</td>
<td>9.7±3.2</td>
<td>3.7°±1.8</td>
<td>3.9°±1.6</td>
</tr>
<tr>
<td>p value</td>
<td>0.4123</td>
<td>0.7047</td>
<td>0.9732</td>
<td>0.4062</td>
</tr>
</tbody>
</table>


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