Introduction

Patient reported outcome measures (PROMs) are commonly used in the total knee arthroplasty (TKA) literature to compare prosthesis, surgical techniques, and in auditing departments and individual surgeons. Recently it has been suggested that PROMs alone are not sufficient to assess patient outcome: Mizner et al. argue that patient reported measures fail to capture the actual changes in functional performance after TKA, and that performance assessments are additionally required to obtain the full picture of the patient’s physical function. Little however is known concerning the relationship between the patient’s report of their functional outcome and direct measurement of this.

The aim of this study was to assess the association between the two types of measurement at different time points prior to and following TKA. Multiple measures of pain and physical assessments of function were examined against the patients’ report of pain and function on the commonly utilised Oxford Knee Score. It was hypothesised that there would be correlation between the OKS and the additional pain and performance measures and also that the variation in OKS would be explained by variation in the additional pain and functional measurements. The stability of this relationship over time following surgery is also assessed.

Methods

We prospectively assessed 183 consecutive TKA patients in the arthroplasty service at the Royal Infirmary of Edinburgh pre-operatively, then at routine outpatient clinical reviews at 6 weeks, 26 weeks and 52 weeks post-operatively. A comprehensive clinical outcome protocol was used to evaluate patient function, comprising the Oxford Knee Score, range of motion, timed battery of performance tests, lower limb power assessment (Leg Extensor Power Rig) and numerical rating scale measures of pain intensity. All tests were carried out by the same researcher in the same manner.

Data was analysed using the Minitab (release 15) software. Differences in outcome at each assessment between the outcome measures were assessed with paired samples t-tests. Correlation of performance variables with the OKS was assessed, and regression analysis performed on those that formed significant associations. Multiple linear regression analysis was employed using a stepwise model building technique to screen out predictors not associated with the response. Significance was accepted at p = 0.05. The adjusted R² value (adjusted for the number of predictors in the model) is reported to allow comparison between models at different time points.

Results

All variables, changed significantly between each assessment time point (p < 0.001 in all cases). This change was almost universally positive in nature, the only exception being a reduction in flexion from pre-operative to 6 week post-operative assessment.

Modest correlation with the OKS was observed for values of power output (r = 0.4) and timed functional tests (r = 0.45). Poor correlation was observed with measure of knee flexion (r = 0.25). These correlation coefficients were consistent across the 4 time points. The correlation of pain measures and the OKS varied over time, correlating poorly pre-operatively (r = 0.3) but well post-operatively (r = 0.7).

Multiple linear regression demonstrated that the results of the pain and functional assessments explain much of the variance in OKS post-operatively. Stepwise modelling was performed to screen out predictors not associated with the response variable (OKS) based on the criteria of alpha (to enter or remove from the model) of 0.05. Only measures of pain, timed functional test and power assessments were consistently relevant.

Differing amounts of the variation in OKS were explained by the model at the 4 time points; 34.8% pre-operatively, 44.0% at 6 weeks, 56.9% at 26 weeks and 62.3% at 52 weeks post arthroplasty. Pain rating scale was found to be the dominant factor in deriving all of these models.

The comparative contribution of the factors that best explained the variation in OKS; pain report, timed functional score and power outputs are displayed in table 1. The stepwise regression model best explained the variation in OKS at all time points, however the report of pain demonstrates values only slightly less than those of the multiple response analysis, again highlighting its stronger association with the OKS compared to the functional assessments.

Table 1 – Comparison of multiple linear regression model with univariate pain, timed test and lower limb power regressions R² adjusted

<table>
<thead>
<tr>
<th></th>
<th>Regression model</th>
<th>Pain reports</th>
<th>Timed score</th>
<th>Power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-op</td>
<td>34.8</td>
<td>20.4</td>
<td>17.9</td>
<td>14.4</td>
</tr>
<tr>
<td>6 weeks</td>
<td>44.0</td>
<td>40.0</td>
<td>15.9</td>
<td>13.4</td>
</tr>
<tr>
<td>6 months</td>
<td>56.9</td>
<td>41.4</td>
<td>29.2</td>
<td>13.2</td>
</tr>
<tr>
<td>12 months</td>
<td>62.3</td>
<td>51.1</td>
<td>23.8</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Conclusion

PROMs measures are commonly used to assess patient functional outcome as they are comparatively cheap, effective at collecting large volumes of data, and do not require follow-up clinic visits to achieve this. In this study however, we found substantial variation in objective assessment of function and patient report of that function through the OKS, and that this relationship changed with time post-operatively.

This is the most comprehensive analysis of a large sample of TKA patients to assess the relationship between physical performance and the patient’s report of that performance prior to and following surgery. Further, it is the first analysis to present regression models at all assessment points to reflect how the relationship between these two types of assessment changed over time.

Regression modelling of the separate pain and direct functional assessments was able to explain only a third of the variation in the patient reported score pre-operatively, but 2 thirds of the variation at one year follow-up. Pain was the only factor that changed in relationship to OKS across the 4 time points, and was the dominant factor in deriving the regression models.

The relationship between assessment of performance and report of performance improved as the patients report of pain diminished, suggesting the patients’ report of functional outcome is influenced more by their pain level than their ability to accomplish tasks.

Significance

Assessment of function post TKA is a pivotal part of determining the success of the surgery. These results question the accuracy of the PROMS measures in representing the observed ability to perform functional tasks, which has implications for assessing outcome.

Reference