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Importance of Full Flexion After Total Knee Replacement in Muslims' Daily Lifestyle

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Abstract: Previous studies show that total knee replacement (TKR) patients have difficulty performing certain tasks involving deep knee flexion which are part of activities of daily living (ADL). Muslims' lifestyles heavily depend on the ability to fully flex the knee, and many daily activities, such as praying, social encounters (attending the Sheikh's majlis), dining or even using the hole bathroom, are carried out on the ground. The LPS Flex implant has been designed to accommodate this by giving up to 165 degrees of flexion. One-thousand and thirty-two (1032) TKRs were performed on patients diagnosed with osteoarthritis using the LPS Flex mobile bearing implant over a five year period with a minimum of 1 year post-operative follow up. The results were then compared to a series obtained from the Zimmer Feedback database which is managed independently by the Audit and Research Office, Department of Orthopaedic and Trauma Surgery, University of Dundee, Dundee, Scotland, United Kingdom. 44% of pre-op cases had full flexion as per our set criteria. There were no apparent differences in patello-femoral pain levels, complications or Knee Society score despite the fact that our patients had, on average, an increase in maximum flexion along with an increase in functional ability. The knee score failed to assess this improved functionality of patients who had full flexion; a new diagnostic method is therefore needed. The results indicate that the implant allows patients to maintain a high degree of flexion and function post-operatively, with few complications.

Key Words: LPS flex implant, full flexion after total knee replacement.

Deep knee flexion is a real concern for Muslim and Asian patients undergoing total knee replacement (TKR). Since, many daily activities, such as praying, dining or using the Oriental toilet, and many social encounters such as attending the shaikh's *majlis (*study circle*)* are carried out on the ground. Many Asian patients decline TKR after realizing that they will not be able to resume their normal lifestyles after surgery.[1]

Even in Western society, a survey of over 200 cases in the USA[2] found that patients who had TKR were physically unable to perform certain activities involving deep knee flexion. Although patients in the aforementioned study did generally have a good Knee Society score and were satisfied with the overall surgical results, they still showed discontent with the restrictions associated with a limited range of motion. These activities, considered by the patients to be vital, included squatting (82%), kneeling (79%), gardening (50%), sexual performance (77%) and dancing (51%).

Most knee systems available in the market have been designed to accommodate a maximum flexion of 130 degrees. The LPS Flex mobile bearing knee was designed to accommodate deeper flexion, and specific considerations were taken into account in

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order to make this possible. This implant has been on the market for over four years. The purpose of this study is to evaluate the clinical experience concerning this implant with an initial assessment of the outcome of 626 patients and to compare the results obtained from this study to a series obtained from Zimmer Feedback database which is managed independently by the Audit & Research Office, Department of Orthopaedic and Trauma Surgery, University of Dundee, Dundee, Scotland, United Kingdom, for TKR.

Patients and Methods

One-thousand and seventy-five (1,075) total knee replacements were performed on 626 patients (247 male, 379 female) diagnosed with advanced osteoarthritis from March 1999 to April 2005. Their average age was 63 years, with a range from 30-96 years. Their average Body Mass Index (BMI) was 31.9, with values ranging from 17.5–55.1. The majority of the patients (490) had simultaneous bilateral total knee replacements, and 177 patients had unilateral knee replacement. The LPS Flex mobile bearing knee manufactured by Zimmer® Inc. was the implant of choice for all patients. Pre-operatively, all patients had AP weight bearing x-rays and maximum lateral flexion x-rays. Knee Society scores were also documented as a part of the diagnostic process. Mean hospital stay was 12.9 days.

The design of the LPS Flex mobile bearing implant has taken into consideration the deep range of motion (up to 165 degrees of flexion) required. The designers have tried to assess any mechanical issues that may arise in the process of deep flexion. The posterior condyle of the femoral component was made thicker and more rounded to allow the tibia to roll back further in deep flexion, as shown in Figure 1. The spine/cam mechanism was redesigned to allow lower contact between the spine and the cam mechanism so the femoral implant does not disengage in deep flexion. To prevent excessive wear on the polyethylene spacer, the femoral component was redesigned to allow more contact area with deep flexion (Figure 2). The patellar groove was deepened to prevent pressure on the patellar tendon and to allow better tracking for the patella. Mechanical testing for polyethylene wear showed that after 5 million cycles (Figure 3) the polyethylene wear for the LPS Flex mobile bearing implant was less than that of the standard IBII.

All surgeries were performed by the same surgeon utilizing the subvastus approach with quadriceps releases carried out in 33 cases (3.3%) where flexion was less than 100 degrees. The approach proceeded through a median parapatellar incision while maintaining the attachment of the vastus medialis on the patella and leaving it intact. Dissections were carried out on the vastus medialis until it was laterally mobilized. Quadriceps releases where carried on in those patients who had limited movement where the quadriceps muscle was dissected free from the anterior surface of the femur; the release was done manually and bluntly as far proximally as needed until a flexion of 130 degrees was obtained. This allowed more quadriceps excursion and enabled the surgeon to sublux the patella laterally. No attempt was made to avert and dislocate the patella. The bone cuts were carried on as per recommendation of the manufacturer. Flexion and extension gaps were balanced using block spacers. Medial collateral releases were performed in 1024 knees (95.3%). Posterior capsule releases were performed in 361 knees (33.6%).

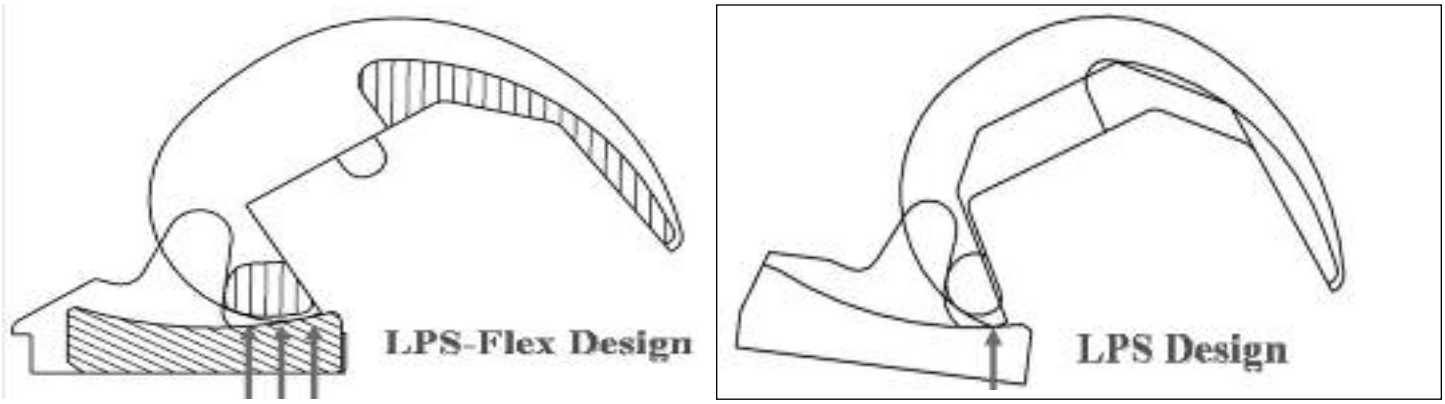

Figure 1 The arrows indicate the increased contact area in the flex design.

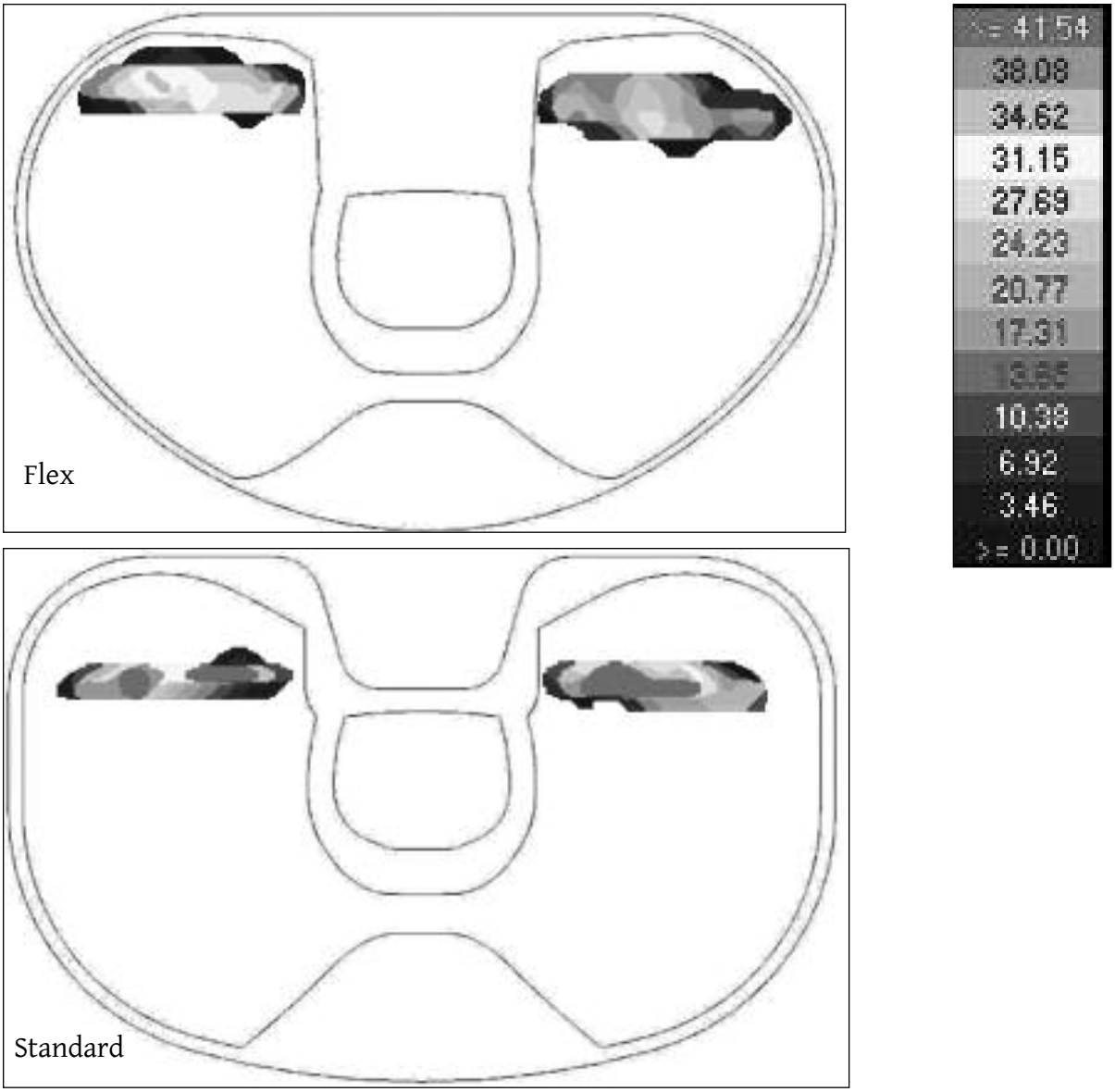

Figure 2 Pressure with deep flexion of 155 degrees in the flex design (a) and the standard design (b) The greyscale bar shows the relative pressure increment in deep flexion.

Patellar resurfacing with a dome component was used in 851 knees (79.2%). Patellar tracking was checked by flexing the knee and extending it, before closure, without any external support for the patella (no thumb technique). Lateral retinacular release was necessary in 67 of the cases (7.1%). All components were cemented in full extension. Hemovac drains were used in all patients and were kept in for 24 hours. After wound closure, the passive range of motion was documented and digital images were taken to determine whether full flexion was attained.

In the first 6 hours post operatively, the knee was kept in 90 degrees of flexion using wedge pillows to decrease blood loss. In the first 3 post-operative days epidural pain management was used via an epidural catheter and a continuous infusion of 0.1% Ropivacaine (Naropin®) and 2mg/ml Fentanyl at a rate of 5 to 15 ml per hour, titrated to obtain good pain relief with full dorsiflexion. All patients were provided with telemonitoring during the use of the epidural. Femoral nerve blocks via a catheter were used in unilateral knee replacement and in cases where patients refused epidural analgesic. The catheter was inserted adjacent to the femoral nerves and continuous infusion was given for the first 3 days.

Physiotherapy was started on day 1 post-operatively after removing the drain and reducing dressing. Physiotherapy consisted of aggressive passive and

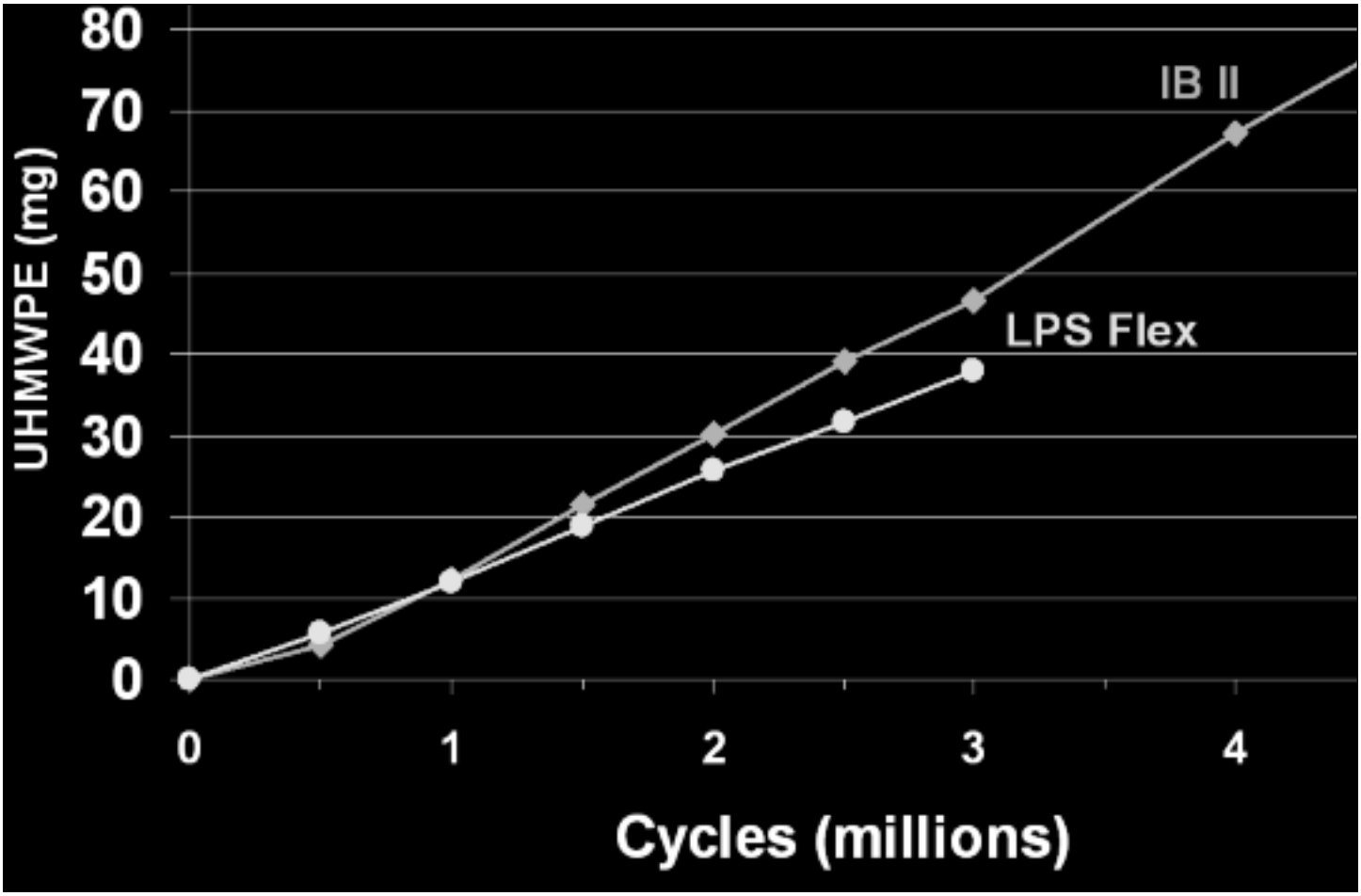

Figure 3. Ultra-high molecular weight polyethylene (UHMWPE) wear of the flex design as compared to the IBII design.

active knee flexion. No continuous passive motion (CPM) machines were used. In the first three days emphasis was placed on obtaining movement rather than standing the patients and ambulating them. Coumadin was used on a daily basis to prevent deep venous thrombosis (DVT). Patients were discharged from the hospital on Coumadin and a proper oral analgesic. Patients had to return to the physiotherapy department for rehabilitation at least once a week for six weeks. There was no home health care available for the patients.

AP and lateral maximum flexion x-rays were obtained at 3 months (optional), 1 year and 2 year post-operative intervals. The surgeon reviewed the x-rays for signs of component loosening or instability such as patella subluxation or knee instability. In addition, he assessed the thickness of the articulating surface. Knee scores were documented at 3 months (optional), 1 year and 2 years post-operatively. Patients were considered to have full flexion if they had the ability to actively bend the knee over 140 degrees and kneel on the ground with their calf in contact with their thigh for at least one minute when they were assessed post-operatively. Statistical analysis was performed using SPSS version 12.

Results

Four-hundred and nine (409) cases (65.4%) had full flexion at the optional 3 months (Figures 4 and 5). All patients who had full movement post operatively had full flexion preoperatively except in 12 cases. Four-hundred and eighty-nine (489) cases (78.1%) had full flexion at 2 years. All patients who had full movement post operatively had full flexion preoperatively except in 3 cases. Average maximum range of motion for our series was 129.6 (90–170) degrees pre–operatively, 140 (115-160) degrees at 3 months, 138.8 (110-160) degrees at 1 year and 142 (115–160) degrees at 2 years. The maximum ranges of motion obtained in our patients using the LPS flex mobile bearing knee were clearly better than those reported in the University of Dundee series using the Nexgen device. The average maximum range of motion var-

Figure 4. Patient with bilateral TKR kneeling with full flexion, as per definition, three months post-operatively (with permission from patient).

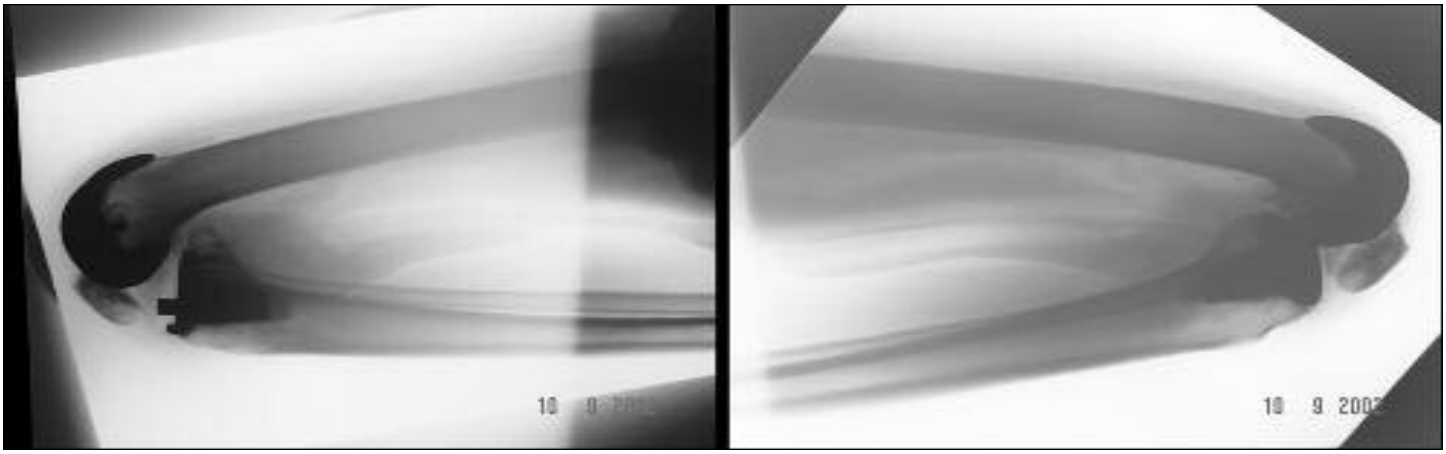

Figure 5. Lateral x-ray of the same patient, three months post-operatively.

ied between 110 and 130 at one year and between 110 and 140 at two years.

The percentage of patients with patello-femoral pain dropped from 73.3% preoperatively to 0.6%, 1.2% and 1.0% at 3-months, 1 year and 2 years post-operatively respectively. The average of the Knee Society scores increased from 21.1 (0-70) points preoperatively to 83 (55-100), 86.8 (20-95) and 86.7 (30-95) at 3-months, 1 year and 2 years post-operatively, respectively. The data comparison between our series and the NexGenTM series showed no significant difference in knee score or patello-femoral pain.

Complication rates were the same in patients who had full flexion and those who did not. These rates were also comparable to the NexGenTM reported series. There were no specific complications that could be attributed to deep flexion. Interestingly, there were also no patellar complications such as dislocation in the series.

Discussion

In general, deep flexion did not lead to an increased complication rate as compared to the other series. On the contrary, our series actually had less patellar complications than those reported in the NEXGEN series.

This might be explained by the fact that compression forces on the patella while squatting are less then those exerted during the descent of stairs, as was reported by Nagura et al.[3] The improved range of motion can be explained by the fact that patients had better ranges of motion pre-operatively despite their ailment; patients thus maintained a better range of motion due to their normal daily activity. Ahlberg et al[4] has shown that patients in Saudi Arabia have on average 15 degrees of flexion more than subjects in Scandinavia. The geographical differences in range of motion were also documented by Hoaglund et al[5] who found a greater range of motion in Chinese populations when compared to Caucasians living in Hong Kong. Another study by Mulholland et al[6] showed that subjects from Hong Kong use less knee flexion than subjects in Chennai, India, indicating that Indians have a higher range of motion. One might be cautious in expecting similar results in Western populations using the same knee replacement device.

Although the range of motion was clearly better in our patients, the knee society score failed to reflect this improvement, despite the clear functional advantage of greater flexion to our patients. We believe, as shown in the aforementioned survey,[1] that the knee society score is inadequate in reflecting the functionality of the patient.

Conclusion

Short term results show that deep flexion is safe and that there is no increased rate of complications that can be attributed to deep flexion. It should be pursued when possible on patients whose daily activities require a higher range of motion to enable them to maintain a good range of motion post-operatively. We had difficulty in finding universal terms describing deep knee flexion activities and their significance. The knee society score has failed to assess the improved functionality of patients who had full flexion. Further techniques should be developed in order for us to assess the daily activity of our total knee patients to reflect the importance of deep flexion. The fact that patients who had better ranges of motion had better function and could therefore normally perform their daily activities makes deep flexion a positive goal to pursue.

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