

The Impact of Using a Used Total Knee Replacement Set on Clinical Outcome

Abstract

Introduction: Success in knee joint replacement surgery depends on various factors, one of which is the correct technique and avoidance of technical errors. This, in turn, requires the use of precise orthopedic instruments and tools. Over time, orthopedic tools may experience wear and corrosion, negatively impacting the clinical outcomes of joint replacement. In this study, we compare the clinical results of two groups of patients operated on with new and used sets, and we examine the effect of wear in this group of patients.

Materials & Methods: Two groups of patients who underwent knee arthroplasty using new and used sets from the same company were compared in terms of range of motion and Oxford scoring. The new and used instrument sets were also compared visually to identify differences in the shape of the instruments.

Results & Discussion: The average extension in the worn group was 7 degrees, while in the new set group, it was 2 degrees. The flexion in the worn set group was 115 degrees, and in the new set group, it was 120 degrees. Statistical calculations showed a significant difference between the two groups in both parameters, with a p-value > 0.05. Regarding the VAS pain scoring, patients in the new set group reported a pain score of 2.5, while the worn set group reported a score of 3. In the examination of the instrument, the diameter of the jig cutting guides for the distal femur was 4 millimeters and for the tibia was 3 millimeters. This measurement in the new set was 2 millimeters.

Conclusion: Bone cutting jigs can undergo mechanical wear and lose their initial accuracy. This loss of accuracy negatively impacts clinical outcomes.

Keywords: Surgical instruments, Total knee replacement, Treatment outcome, Knee.

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Introduction

Knee joint replacement surgery is one of the most successful orthopedic procedures in terms of improving function and reducing pain in patients with knee osteoarthritis. Surgical precision is crucial for achieving proper alignment^(1,2). The instruments used during surgery, such as cutting guides, reamers, and trial components, must have high accuracy and optimal performance. However, the use of worn instruments, primarily due to multiple sterilizations and corrosive wear, can disrupt the accuracy of prosthesis placement⁽³⁾. Surgical instruments in total knee arthroplasty are mainly designed for precise bone cuts and soft tissue balancing. The wear and tear of these instruments can disrupt critical stages of the surgery and lead to poor surgical outcomes. Damaged guides and jigs can also lead to errors in angle measurement and ultimately disrupt the alignment of the implant, which can result in reduced range of motion and pain. The risks posed by worn instruments can also relate to prolonged surgery duration and increased infection risk^(4,5).

In this article, we compare the clinical outcomes of two series of patients who underwent knee joint replacement surgery using the same surgical system but with two different sets based on wear and performance, and we examine the causes and effects of using worn sets on unfavorable outcomes.

Materials & Methods

Between 2022 and 2024, 270 patients underwent knee joint replacement surgery at our hospital. Among these, 43 patients with severe osteoarthritis or rheumatoid arthritis were excluded from the study. Two patients were also removed due to infection. Forty-two patients were operated on using Stryker instruments and 183 patients using Depuy-Synthes instruments. Only these 183 patients were included in the study. Sixty-three patients were lost to follow-up, leaving 120 patients for analysis, consisting of 105 women and 15 men. The average age of patients in this study was 63.7 years. All patients were operated on by a single surgeon. We had two sets of Depuy instruments in this study, with the first 17 patients operated on using the old set and the subsequent 103 patients using the new set. A bone saw system was used in both groups, and the thickness of the saws was the same in both groups. A used insertion set was defined as a set that had been used and re-sterilized many times and had signs of wear visible to the surgeon.

The old set had been in use for ten years. For all patients, Oxford and WOMAC scores were recorded by an orthopedic assistant at least 6 months and a maximum of 18 months post-surgery, and statistical results were compared between the new and old groups using SPSS software.

The Chi-square test with a p-value of less than 0.05 was used to determine the significance of differences in results. The average knee flexion and flexion contracture were compared between the two groups. VAS scores from 0 to 10 were used to assess pain levels. Additionally, we meticulously compared each instrument from the old and new sets visually for bending and deformity. The level of wear was compared by measuring the width of the jig cutting guides in both groups.

Results

Table 1 shows the clinical results of the new and worn sets. As observed, there is a significant difference between the two groups in terms of WOMAC and Oxford questionnaires. The average pain level measured by VAS in the worn set group was 3 (0-6),

while in the new set group, it was 2.5 (0-6). In terms of comparing instrument deformity, we did not find significant visual differences between the two sets. However, the width of the jig cutting guides for the distal femur and proximal tibia was markedly different, with corrosive wear in the old set causing a widening of 4 millimeters in the femur jig and 3 millimeters in the tibia jig (Figure 1). This widening allows pendulum movement of the orthopedic saw blade and could result in the removal of more bone than intended.

Discussion

In this study, the clinical outcomes of patients operated on with both worn and new sets of knee replacement instruments were assessed, showing greater range of motion in the new set. It was also established that corrosive wear in the used set could gradually lead to widening of the jig cutting guides, resulting in more bone removal in the distal femur and proximal tibia. Wear is a significant degradation process in materials caused by interactions between reactions and mechanical stresses and can lead to the deterioration of components exposed to mechanical forces^(6,7).

Attention to the potential for corrosive wear is essential not only to maintain accuracy in surgical techniques but also to minimize the risk of failure in knee joint replacements⁽⁸⁾. Bone cutting jigs primarily have grooves where the orthopedic saw blade enters and performs the bone cutting along these grooves. The diameter of these grooves corresponds to the diameter of the saw blade to prevent pendulum movement and ensure precise cuts strictly along the jig grooves. Over time, continuous use of the saw blade and the development of corrosive wear increase the diameter of these grooves, allowing pendulum movement of the saw blade, resulting in greater bone removal (Figure 2).

Excessive bone removal from the distal femur leads to instability during knee flexion and creates an imbalance in flexion and extension. These technical errors ultimately reduce the knee's range of motion and lead to flexion contractures. The clinical findings in our patients with the worn set align with the widening of the jig guides in this group.

Table 1: clinical results of used and new set of arthroplasty				
	mean	n	SD	P value
oxford	Old=39.57 New=39.74	Old=17 New=103	7.94 8.9	0.87
WOMAC	Old=14.36 New=13.02	Old=17 New=103	0.6 0.7	0.17

Table 2: Range of motion of knee after total knee arthroplasty using used and new sets		
	flexion	Flexion contracture
New set	120 (100-135)	2 (0-5)
Used set	115 (90-130)	7 (0-20)
P VALUE	0.08	0.1



Figure 1: The widths of cutting slot in old set is twice as new one.



Figure 2: Due to wider slot in old case more bone is resected using old set

Conclusion

Despite the use of advanced technology, orthopedic sets can experience corrosive wear, disrupting measurement accuracy during surgery. These errors may remain hidden for a long time and impact clinical outcomes. Timely replacement of replacement sets is essential for knee joint replacement surgery.

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