WHICH KNEE IS THE CANDIDATE FOR TKA? - DETERMINATION OF MORE SYMPTOMATIC SIDE IN BILATERAL KNEE OSTEOARTHRITIS USING STANDING BALANCE ANALYSIS -

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INTRODUCTION

The knee osteoarthritis (OA) often occurs in bilateral knees. When total knee arthroplasty (TKA) is indicated for these patients, it is sometimes difficult to determine which side should be first to perform surgery. It is usually determined by patient's history, complaints, clinical symptoms, physical conditions and radiographic findings. However, these factors are not always consistent with each other. Standing balance is one of the good indicators of the severity of OA as it reflects compensation motion against less functional knee [1][2]. The aim of this study was to establish the method to determine which knee is more symptomatic and more appropriate candidate for TKA from the standing balance analysis, leading to obtain better objective and subjective results after the TKA.

METHODS

Twenty patients with bilateral knee OA and ten healthy subjects with no surgical history of lower extremities (controls) were involved in this study. No patient had any symptoms in either the hip or ankle joint. The patients were from 66 to 81 (mean 74) years old and controls were from 60 to 64 (mean 62) years old. After informed consent, all the subjects were examined with balance and posture analysis system, using six retro-reflective markers, five cameras (Pro-reflex, Qualysys) and a force plate (AM6110, Bertec). Hip, knee, ankle kinematics and knee kinetics were evaluated with the system. These mechanics was calculated using an inverse dynamics approach. The patients were asked to perform relaxed standing, placing one foot on a force plate (Fig. 1). First, knee resultant force (% body weight) was calculated on bilateral knee. Both knees in one patient were divided into higher force side (H side) and lower force side (L side). Second, the angles (degrees) of hip extension, knee flexion and ankle dorsal flexion on each side were evaluated. In addition, the correlation between the knee resultant force and the joint angles were examined on both sides. Finally, pain and radiograph findings were evaluated on each knee. Pain evaluation was based on HSS score and radiographic findings were classified using Kellgren-Lawrence classification. Unpaired t-test was used to determine the difference in knee kinetics between OA patients and control subjects. An analysis of variance (ANOVA) with a single factor was used to determine the difference in hip, knee and ankle kinematics between H and L side. A p-value of < 0.05 was considered significant.

RESULTS

1, Knee resultant force

The averages of knee resultant force (%BW) were 58 in H side, 34 in L side. There was a considerably large side-to-side-difference in OA patients compared with controls (Fig. 2). Value of H side divided by that of L side was 1.70 in OA patients and 1.11 in controls (P<0.01).

2, Angles of hip extension, knee flexion and ankle dorsal flexion

The average degrees of hip extension, knee flexion and ankle dorsal flexion in OA patients during standing were not significantly different, though knee flexion angle of L side was a little larger than that of H side (Fig. 3).

3, Comparison of HSS pain score and radiographic findings

Regarding patient’s pain, 12 of 20 cases indicated the same score (gray area, Fig. 4) between H and L sides. By analysis of the rest 8 cases, L side knees were more painful than H side in 6 cases (white area), and H side knees were more painful in only 2 cases (black area). In radiographic findings, 16 of 20 cases were judged as the same grade in both sides. In the remaining 4 cases, L side had severer OA change than H side (Fig. 4).

DISCUSSION

From the standing balance analysis, the knee resultant force was considerably different between both knees even when having same pain level and radiographic OA. This suggests that standing balance analysis can tell a delicate side-to-side difference in symptoms even when both knees are similar in routine clinical findings. Patients with bilateral knee OA may have their own preference for more functional knee. Therefore, standing balance analysis can be a useful diagnostic examination when puzzled in choosing which knee is a better candidate for TKA in cases with bilateral knee OA. Less functional knee, which has lower force in relaxed standing, may be a better candidate for TKA.

REFERENCES