COMPARISON OF RADIOGRAPHIC MEASUREMENT IN PROXIMAL OSTEOTOMY FOR HALLUX VALGUS

INTRODUCTION:

The hallux valgus angle (HVA) and the 1-2 intermetatarsal angle (IMA) are essential factors for the assessment of hallux valgus. However, there are no generally accepted standards for determining the appropriate anatomical landmarks to define the longitudinal axis of the first metatarsal. Therefore, it is difficult to compare various published studies due to the different methods used for measuring the HVA and IMA.

The purpose of this study was to clarify the most reliable method for radiographic measurements of HVA and IMA in hallux valgus.

MATERIALS AND METHODS:

Forty plain weight bearing dorsoplantar radiographs (20 radiographs each before and after proximal first metatarsal osteotomy) were examined. Three orthopedic surgeons were asked to draw the axis of the first metatarsal by employing four different methods (A: by bisecting the shaft of the metatarsal at two levels, B: by connecting the center of the articular surface of the metatarsal head with that of the proximal articulation, C: by connecting the center of the head of the metatarsal and the center of the base of the metatarsal, D: by connecting the center of the head and the center of the proximal part of the shaft) (Figure 1). These four measurements were repeated after at least one week.

Analysis of variance was used to compare the data between the groups. The intraobserver and interobserver reproducibility was estimated by using the intraclass correlation coefficient (ICC).

RESULTS:

Statistically significant differences were observed between methods used for the postoperative measurements of the HVA (P < 0.005) and the preoperative and postoperative measurements of the IMA (P < 0.0001) (Figure 2). In the preoperative measurements, the mean values of the HVA and IMA ranged from $33.5^\circ \pm 6.8^\circ$ to $35.3^\circ \pm 7.2^\circ$ and $15.8^\circ \pm 3.0^\circ$ to $17.5^\circ \pm 3.2^\circ$, respectively. In the postoperative measurements, the mean values of the HVA and IMA ranged from $13.0^\circ \pm 5.7^\circ$ to $15.1^\circ \pm 6.4^\circ$ and $8.5^\circ \pm 2.7^\circ$ to $10.7^\circ \pm 3.1^\circ$, respectively. No statistically significant differences were observed for each method with regard to the HVA and IMA between the observers.

The intraobserver correlation coefficient of the HVA was more than 0.95 preoperatively and 0.91 postoperatively. The intraobserver correlation coefficient of the IMA was more than 0.85 preoperatively and 0.79 postoperatively. The intraobserver correlation coefficients were excellent for methods C and D (ICC $\geq 0.85$) (Table 1). The interobserver correlation coefficients of the HVA for the preoperative and postoperative measurements were more than 0.95 and 0.90, respectively. The interobserver correlation coefficients of the IMA for the preoperative and postoperative measurements were more than 0.85 and 0.78, respectively. Overall, method C produced the best interobserver reproducibility (ICC $\geq 0.85$) (Table 2).

DISCUSSION:

Substantial differences may occur in the angular measurements depending on the specific reference points used in hallux valgus. Our study demonstrated that statistically significant differences were observed between each method in the postoperative measurements of the HVA and in the preoperative and postoperative measurements of the IMA. This result supports that it is necessary to determine the most reliable method of measurement of the HVA and IMA.

The primary reasons for the interobserver inconsistency in radiographic measurement are intrinsic to selecting landmarks of measurement. Our results showed that the intraobserver and interobserver reproducibility of the preoperative and postoperative measurements of the HVA and IMA were good for all the four methods when the landmarks for measurement were defined.

In recent literatures, method C and D are recommended for a distal osteotomy. In this study, we found that method C (connecting the center of the head of the metatarsal with the center of the base of the metatarsal) produced the best intraobserver and interobserver reproducibility in a proximal osteotomy. Therefore, we believe that method C is most reliable for measuring the HVA and IMA in hallux valgus.

REFERENCES: