

Radiographic analysis of the kinematic total knee replacement

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Kinematik total diz protezi radyolojik değerlendirilmesi

Total diz protezinin amacı komponentlerin pozisyonu ve alignmentinin teknik mükemmelliğidir. 41 total diz protezinin erken analizi yapılmıştır. Cerrahi teknik Hungerford ve arkadaşlarının oluşturduğu prensipler temelinde uygulanmıştır. Tibial kesici guide her zaman 3° varusta tutulmuştur. Femoral kesici guide üç ayrı derecede 7, 9, 11 seçilmiştir. Her dizde operasyondan sonra radyolojik değerlendirme yapılmış beklenen ve elde edilen değerler arasındaki fark hesaplanmıştır. Femoral bölge için belirgin şekilde varus yönünde hata ortaya çıkmıştır. Alfa açısındaki varus hatalarının istatistiki değerlendirilmesi anlamlı bulunmuş, ortalama varus 3, 54° bulunmuştur. Hesap edilen α açısına 3° eklenmeli ve en yakın femoral kesme guide'i seçilmelidir. Tibial komponentte hata her iki yöne de eşitti. Bu tibial alignment guide'nin extramedüller olmasına bağlı olabilir.

Uzun dönemli sonuçlar komponentlerin doğru uygulanmasına bağlıdır. Bu da preoperatif ölçüm ve planlamanın son derece önemli olduğunu ortaya koymaktadır.

Anahtar kelimeler: Total diz protezi, radyolojik analiz

Technical perfection of alignment and component position are the goals of the total knee arthroplasty. Early analysis of 41 kinematic total knee replacement was made. Surgical technique is produced on the basis of the principles of Hungerford and associates. Tibial cutting guide is always in 9 degrees varus. The femoral cutting guide can be adjusted to three different angles which are 7, 9 and 11 degree. Radiographic analysis was done after operation for each knee. The difference between the expected and assessed value, were determined. For femoral side the errors were prominently in the varus direction. Statistical analysis of the varus errors in the angle alpha is meaningful and the average of varus errors is 3. 54 degrees 3 degrees must be added to angle α and the nearest degree in the cutting guide must be chosen. In the tibial component errors were equal on each side. This may depend on extramedullary tibial alignment guide.

Long term results depend on the correct application of the components. It seemed that preoperative measurements and careful planning were extremely important.

Key words: Total knee replacement, radiographic analysis

The long-term results of total knee arthroplasty are largely dependent on the degree to which the resultant knee duplicate the normal joint anatomy, mechanics and kinematics. In the last two decades, total knee arthroplasty has evolved to a substantial degree with respect to both design and technique. Because of the specific structure and kinematics of the knee, tolerable misalignment range is low. Specific surgical techniques must strictly be followed in order to look for good long-term results. As many authors, of a knee prosthesis has been replaced with a good technique, in a correct alignment, without infection, it would rarely be loosen.

The knee joint is anatomically aligned only when the projection of the resultant weight-bearing force passes through the surface loading midpoint of the hip, knee and ankle in a straight line and the trans-

verse plane of the articular surface of the knee is horizontal to the ground.

There are two different concepts on the angle between mechanical axis and the prosthesis. According to Hungerford, man walks in a narrow basis, so in order to produce a knee joint which is parallel to the ground, one must cut the tibia slightly in varus. In accordance with this, femoral cutting angle must be the sum of the femoral valgus and the previous tibial cutting angle. In contrast to this, Insall says, these patients walk in a wide basis because of their age and illness. So it is not necessary to produce a varus transverse axis. He prefers to cut the tibia in right angle. In the technique femoral valgus angle is equal to angle α .

Kinematic knee series is produced on the basis of

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the principles of Hungerford and associates. Application of the prosthesis is made by Universal Knee System devices. The tibial cutting guide is always in 3 degrees varus. However the femoral cutting guide can be adjusted to three different angles which are 7, 9 and 11 degrees. Finally extremity alignment must be fully corrected when both cut surfaces are held together. In this point of view we made the radiological analysis of 41 total knee replacements which were performed in Hacettepe University Hospital.

Preoperative and postoperative radiograms are evaluated. For each knee angles are measured and noted. Real angle α is calculated by the method which is described by Jiang and Insall. Expected angles are calculated according to the specific technique. Expected angle α is calculated by the formula $\alpha = 93 + a$. The difference between postoperative angle α and expected angle α is noted. Statistical analysis is made for the errors of varus and valgus directions.

The constant expected angle β is $90 - 3 = 87$ degrees. Postoperative angle β is correlated with the constant expected angle β . Statistical analysis is made for the errors in both directions.

If we summarize the statistical results: For the angle α , errors in varus direction are found to be more than in valgus direction, and the differences between the errors are meaningful. For the angle β , errors to both directions are equal in number and the differences between the errors in both directions are not meaningful.

Calculations showed that, in tibial component, errors are equal in number and are near in value. This result may depend on the kind of the tibial alignment guide. Extramedullary tibial alignment guide permits to produce errors in both directions.

Calculations for femoral α angle show that varus errors are higher in number and value. Because the femoral alignment guide is intramedullary, it does not permit to produce errors in application as in the tibial guide. However, errors can occur in calculation of the angle α and the application of angle α to the cutting guide. Statistical analysis of the varus errors in angle α is meaningful, and the average of the varus errors is 3.54 degrees. As we have mentioned before, femoral cutting guide can be selected from 3 different degrees: 7, 9 and 11 degrees. For the best selection, 3 degrees must be added to angle α and the nearest degree in the cutting guide must be chosen. If this sum is neglected, a 3 degree of varus error is permitted even before the operation. The average varus error of 3.54 degrees may suggest this sum may have been neglected. In addition we think that, to have only three different degrees for the femoral guide is not enough for a good selection for femoral cutting.

It is very clear that long-term results certainly depend on the correct application of the components. There are excellent studies about the correlation between misalignment and loosening. However, the tolerable limits differ for each author. Evaluation of our results showed that there are very few cases which are beyond these limits. We believe that it may be very meaningful if these radiological results are evaluated with clinical results in a long-term study.

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