

THE EFFECT OF SALTER INNOMINATE OSTEOTOMY ON FEMORAL ANTEVERSION IN DEVELOPMENTAL DYSPLASIA OF THE HIP: A PRELIMINARY REPORT

GELİŞİMSEL KALÇA DİSPLAZİSİ TEDAVİSİNDE SALTER İNNOMİNAT OSTEOTOMİSİNİN FEMORAL ANTEVERSİYONA ETKİSİ: ERKEN BİLDİRİ

Mutlu VURAL, M.D., Selçuk BÖLÜKBAŞI, M.D., Erdal CİLA, M.D.,
Necdet Ş. ALTUN, M.D., Aykın ŞİMŞEK, M.D., Ulunay KANATLI, M.D.

Gazi University, Faculty of Medicine, Department of Orthopedics and Traumatology, Ankara-Turkey

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ABSTRACT

Purpose: To study whether surgical correction of excessive femoral anteversion was necessary or not during Salter innominate osteotomy. Children who had been treated by this operation were followed to determine the changes in femoral anteversion. **Methods:** Twenty-three developmentally dysplastic hips of one male and fourteen female patients, whose ages ranged from 1.5 to 3.5 years, were treated. During follow-up, the children were evaluated for the changes in the femoral anteversion values after the acetabular redirection operation. The femoral anteversion was measured by using computer tomography preoperatively and one year after surgery. **Results:** At the end of the first postoperative year, there was a mean decrease of 2.51 degrees (range -0.8 to 9.4°) in femoral anteversion and this decrease was found to be statistically significant ($p < 0.05$). **Conclusion:** Although Salter innominate osteotomy does not accelerate the decrease of the femoral anteversion values, it allows a similar decrease with the normal hips.

Key Words: Developmental Dysplasia of the Hip, Salter Osteotomy, Femoral Anteversion.

INTRODUCTION

Developmental dysplasia of the hip (DDH) is still an important problem and has an incidence of 1.34 percent in Turkey, where inter-relative marriages and the application of traditional swaddling in an extension and adduction position of the hips is common (1).

Salter innominate osteotomy has been an effective treatment method for DDH since it was first described in 1961. According to Salter, the main problem in DDH was malrotation and

ÖZET

Amaç: Salter innominate osteotomisi ile tedavi edilen çocuklarda aşırı femoral anteversiyonun cerrahi olarak düzeltilmesinin gerekip gerekmediğini ortaya koymak için bu çalışmada Salter ameliyatı sonrası femoral anteversiyon değişikliğini değerlendirdik. **Hastalar ve Metod:** Gelişimsel kalça displazisi nedeniyle cerrahi tedavi uygulanan bir erkek 14 kız hastanın 23 displastik kalçası bu çalışmaya dahil edildi. Yaşları 1.5 ile 3.5 arasında değişen hastalara ameliyat öncesi ve sonrası bilgisayarlı tomografi ile femoral anteversiyon ölçümü yapıldı. **Bulgular:** Ameliyat sonrası birinci yılda femoral anteversiyonda 2.51° (-0.8° - 9.4°) lik bir azalma tespit edildi ve bu istatistiksel olarak anlamlı bulundu ($p < 0.05$). **Sonuç:** Salter innominate osteotomisi femoral anteversiyondaki azalmayı hızlandırmasa bile, normal kalçalarda izlenen doğal femoral anteversiyon azalma seyri etkilememektedir.

Anahtar Kelimeler: Gelişimsel Kalça Çıkağı, Salter Osteotomisi, Femoral Anteversiyon.

excess anteversion of the acetabulum. Therefore, he designed an operation that rotated the acetabulum laterally and anteriorly. Salter believed that if malrotation of the acetabulum was corrected, there was no further need to surgically correct the increased femoral anteversion (2-5). However, the degree of femoral anteversion that can be accepted and the timing of the surgical correction are controversial (5).

The purpose of this study was to assess the

changes in femoral anteversion in a group of children with DDH and were surgically treated by Salter innominate osteotomy and to use this as a guide to decide on whether or not it was necessary to correct the femoral anteversion during surgical treatment by Salter osteotomy.

PATIENTS AND METHODS

Between 1995 and 1997, twenty-three hips of fifteen children with DDH were treated by open reduction and Salter innominate osteotomy. Age of the patients ranged from 18 to 42 months. Fourteen of them were female and one of them was male.

The femoral anteversion was determined before and one year after surgical treatment by computer tomography (CT) by using the Hernandez technique. This technique uses the horizontal sections at the suprapatellar region of the femur and the femoral neck region as guides. After taking the horizontal sections, the angle between the femoral neck and the distal axis of the femur are measured and this directly corresponds with the femoral anteversion angle (6, 7) (Fig. 1-A-B and Fig. 2-A-B).

Preoperative and postoperative first year femoral anteversion measurements of twenty-three hips were obtained and compared statistically by using the paired t-test. Then, femoral anteversion values of the seven unilateral cases were obtained simultaneously with the

unaffected side. The Wilcoxon test was used to compare the two groups of measurements for the unaffected hip.

All the patients were chosen according to Salter's indications and prerequisites (3-5). After preoperative traction, a standard Salter operation was performed (Fig. 3-A-B.)

RESULTS

Table 1 demonstrates the femoral anteversion measurements taken preoperatively and at the postoperative first year. The mean preoperative femoral anteversion was 35.73 degrees and this was 33.22 degrees at the end of the first postoperative year. This difference was found to be statistically significant ($p=0.025$).

Femoral anteversion values of unilateral cases, which were obtained simultaneously with the affected side before and after surgery (Table 1.) There were seven such cases and the mean femoral anteversion before treating the affected side was 30.42 degrees which decreased to 28.82 degrees one year after treatment. There was a statistically significant difference between the groups ($p=0.043$).

DISCUSSION

In a normal individual, femoral anteversion is neutral in the first half of intra-uterine life, increases to thirty to thirty-five degrees at birth and then slowly decreases to the adult value of



Fig. 1: Tomographic section of the proximal part of the femur. Line 1 on the graph represents the axis of the femoral neck and head (A). Tomographic section of the distal part of the femur at the proximal end of the patella. Line on the graph represents the transverse axis of the femur. Anteversion angle is the difference between these two angles (B).

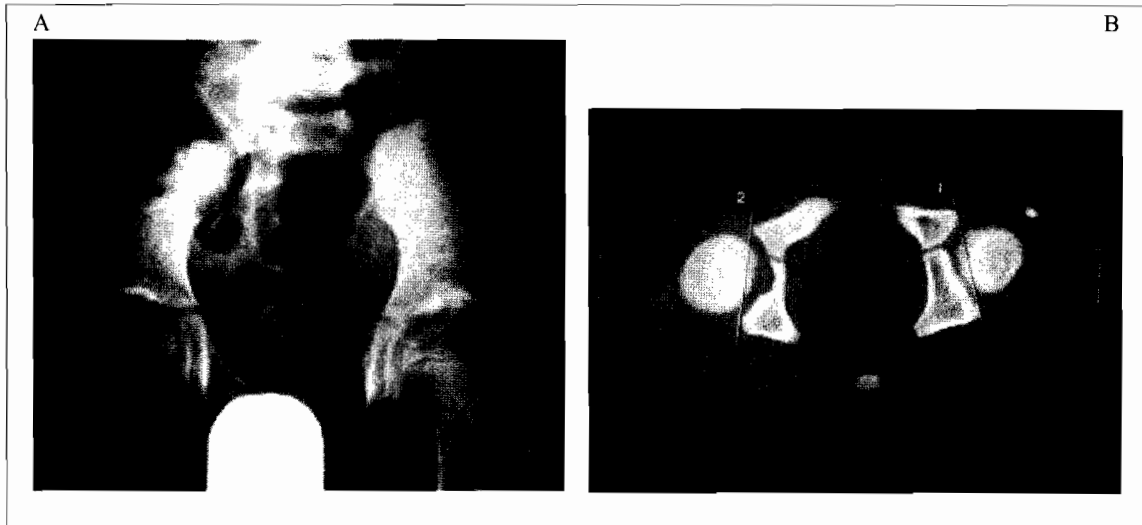


Fig. 2: Anteroposterior pelvic roentgenogram of the patient on figure 2, at the postoperative second year. Last position, and the development of the hip joint can be seen (A). Pelvic tomographic section of the same patient at the postoperative second year. Last position, and the development of the hip can be seen (B).



Fig. 3: Anteroposterior pelvic roentgenogram of a patient with right dislocated and left subluxated hip (A). Pelvic tomographic section of the same patient showing the dislocated position of the femoral head and the peripheral soft tissues (B).

ten to fifteen degrees (5, 8, 9). However, patients with DDH have excessive femoral anteversion and valgus and this does not correct itself especially after the patient is three years old, causing a series of problems. Salter innominate osteotomy redirects the acetabulum to obtain a stable hip joint in the functional weight-bearing position. Salter believes that when this is achieved, the proximal femur gains a chance to show normal development. This operative technique is still used successfully by orthopedic surgeons from all over the world (2-5, 10, 11). In

spite of Salter's views, there is controversy on the necessity and timing of surgical correction of excess femoral anteversion (5, 12).

In 1974 Serafimov studied the natural history of femoral anteversion after Salter innominate osteotomy, by using direct radiograms. In that study Serafimov followed fifty hips of thirty-nine patients for two years (13) and used Ripstein-Müller technique (14-16) for measuring femoral anteversion, finding a mean decrease of twenty-two degrees (range eight to thirty-four degrees).

Table - 1 : Femoral anteversion values measured preoperatively and at the end of the first postoperative year. The underlined numbers represent anteversion measurements taken on the normal hip side of unilateral DDH cases.

Case No	Side	Preoperative		Postoperative First Year	
		Femoral Anteversions		Femoral Anteversions	
		(Degrees)		(Degrees)	
		Right	Left	Right	Left
1	Left	26	35	23	33
2	Right	40	35	39	35
3	Bilateral	37	38.4	34.3	34
4	Bilateral	35.4	33.2	35	34
5	Right	45.4	24.7	36	21
6	Right	31.4	27.9	30	26
7	Bilateral	34	33.4	34	33
8	Right	36.8	28	37	28
9	Bilateral	48	45	43	45
10	Bilateral	43.5	46.7	39.4	39.2
11	Bilateral	26	29	25	26
12	Bilateral	15	34	12	29
13	Right	42.5	46.4	42.2	44.8
14	Bilateral	27.2	34	26	32
15	Left	25	31	24	26

This method of measurement was rather difficult and later in 1981, Hernandez used CT for measuring femoral anteversion, which was easier and more precise (6, 7, 17-21). In the present study, in order to obtain more reliable data, we used the Hernandez technique to measure femoral anteversion.

Our approach to children with DDH has not included surgical correction of femoral anteversion, even when the anteversion exceeds fifty degrees. Our results in this study have shown that there is a statistically significant decrease in femoral anteversion of the unaffected hips of children with unilateral DDH, which is an expected finding. However, there is a similar decrease in femoral anteversion of the affected hips one year after Salter osteotomy. In our opinion, this shows that femoral anteversion will gradually correct itself and despite the good results of Salter innominate osteotomy, this natural history, was not found to be affected by the osteotomy. Although the follow-up period is short for this study, this is a preliminary report and we expect that this improvement will continue throughout later years. It is perhaps possible to document this further improvement by CT follow-up, but we are not planning such a study because of possible radiological hazards.

Correspondence to: Selçuk BÖLÜKBAŞI, M.D.
Gazi Üniversitesi Tıp Fakültesi
Ortopedi ve Travmatoloji Anabilim Dalı
Beşevler
06500 ANKARA - TÜRKİYE
Phone : 312 240 41 52
Fax: 312 212 90 08
E-mail: selcukb@superonline.com

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