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# Rafting technique without bone grafting in reverse Hill-Sachs lesions

## Ters Hill-Sachs lezyonlarında kemik greftlemesi olmaksızın rafting tekniği

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***ABSTRACT***

In this article, we report a case of bilateral posterior shoulder instability, having reverse Hill-Sachs lesions of 25 to 50% of the articular surface on the right side, and of 50% on the left side. The defects were anatomically reconstructed after tuberculum minus osteotomy by elevation of the articular surface and buttressing with raft screws without graft usage. Early rehabilitation with pendulum shoulder exercises was started at third postoperative day. At postoperative sixth week, patient had full range of motion without instability and pain. At postoperative 18th month, the patient had normal physical examination and the constant shoulder score was 86, which was 92.4% of the age- and gender-matched population. Rafting technique without bone grafting may be a treatment alternative with satisfactory clinical results for medium to large sized reverse Hill-Sachs lesions of posterior shoulder instability.

***Keywords:*** Bone grafting; joint instability; reconstruction; reverse Hill-Sachs lesion; shoulder dislocation.

***ÖZ***

Bu çalışmada, sağ tarafta eklem yüzeyinin %25-50'si ve sol tarafta %50'si kadar ters Hill-Sachs lezyonu olan çift taraflı bir posterior omuz instabilitesi olgusu bildirildi. Defektler tüberkulum minus osteotomisi sonrası eklem yüzeyinin yükseltilmesi ve greft kullanılmadan raft vidaları ile desteklenmesi yoluyla anatomik olarak yeniden yapılandırıldı. Ameliyat sonrası üçüncü günde pandüler omuz egzersizleri ile erken rehabilitasyona başlandı. Ameliyat sonrası altıncı haftada hastanın hareket açıklığı instabilite ve ağrı olmaksızın tam idi. Ameliyat sonrası 18. ayda hastanın fizik muayenesi normal ve constant omuz skoru yaş ve cinsiyet dengi popülasyonun %92.4'ü olacak şekilde 86 idi. Kemik greftlemesi olmaksızın rafting tekniği, posterior omuz instabilitesinde orta ila büyük boyutlu ters Hill-Sachs lezyonlarında tatmin edici klinik sonuçları ile bir tedavi alternatifi oluşturabilir.

***Anahtar sözcükler:*** Kemik greftlemesi; eklem instabilitesi; yeniden yapılandırma; ters Hill-Sachs lezyonu; omuz çıkığı.

Bilateral simultaneous shoulder dislocation is a rare injury. It usually occurs secondary to epileptic seizure and most of them are posterior.[1,2] Posterior shoulder dislocations are frequently associated with an anterior impression fracture of the humeral head. The size of this impression defect, the reverse Hill-Sachs or the McLaughlin lesion designates the treatment. It is well-documented that posterior capsular shift and posterior Bankart repair do not effectively address the instability with engaging reverse Hill-Sachs lesions.[3,4] Conservative treatment is recommended for bony defects involving less than 20-25% of the humeral head.[5,6] For large defects which are greater than 45-50% of the head, hemi or total shoulder arthroplasty is advised in the literature.[5,7,8] Medium defects involving 20-50% of the humeral head can be treated by non-anatomical reconstructions of filling the defect by the subscapularis tendon (McLaughlin procedure) or the lesser tuberosity.[2,5] Anatomic reconstruction procedures for this size of defects are structural allograft or autograft augmentation of the defect either after elevation of the impressed segment or by filling the defect.[2,9,10]

Rafting technique can be defined as the buttressing of a depressed osteochondral fragment with raft of screws or even Kirschner wires.[11,12] This technique is described especially for depressed tibial plateau fractures.[13]

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**Figure 1.** Anteroposterior radiogram of both shoulders at initial evaluation.

In this article, we report a case of bilateral posterior shoulder instability, with reverse Hill-Sachs lesions, which we treated by tuberculum minus osteotomy followed by elevation of the impressed osteochondral defect and supported by underpinning raft screw technique without grafting. We aim to underline the clinical outcomes of anatomical reconstruction of the sphericity of the humeral head and review advantages and disadvantages of the reported technique.[14]

## CASE REPORT

A 32-year-old male patient was consulted by our clinic with bilateral shoulder pain and loss of motion after two episodes of epileptic seizure. The patient was semi-conscious when he was evaluated for shoulder pain. Only anteroposterior shoulder radiograms of both shoulder were present (Figure 1), and we could not get axillary lateral, trauma axillary lateral, Velpeau axillary lateral or lateral scapular Y view X-rays. We demonstrated posterior locked dislocations of both shoulders with large reverse Hill-Sachs lesions on computed tomography (CT) scans. Closed reduction was attempted under general anesthesia for both shoulders. Right shoulder was instable with abduction greater than 30° and internal rotation greater than 10° after closed reduction. Left shoulder was locked posteriorly and closed reduction was not possible.

On CT scans, the anterior head defect was measured to be between 25% and 50% of the articular surface of the head on the right side, and 50% on the left side (Figure 2).

The shoulder joints were reached through a deltopectoral approach with the patient in beach-chair position. A tuberculum minus osteotomy beginning at the medial edge of the intertubercular

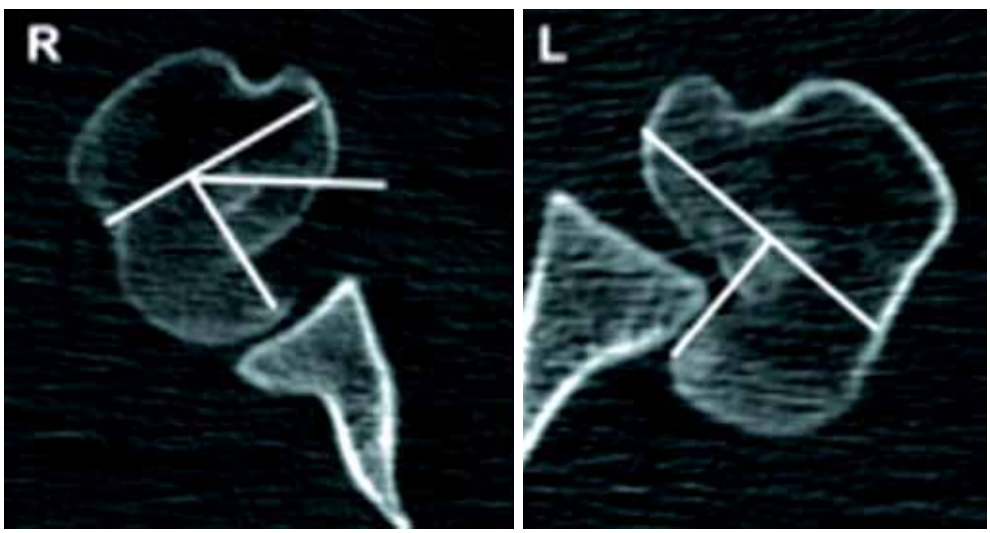


**Figure 2.** Axial computed tomography scanogram previewing extent of osteochondral defect on both humeral heads.

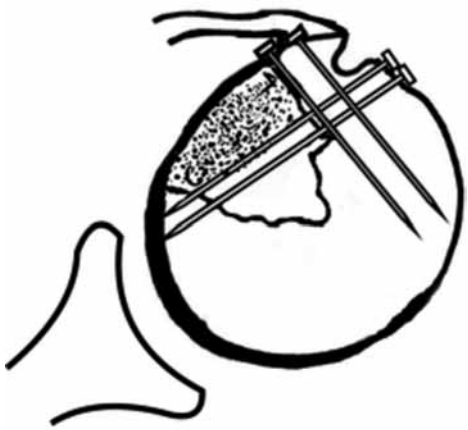

**Figure 3.** Schematic drawing showing buttressing of osteochondral fragment and fixation of tuberculum minus with screws.

sulcus extending medially was performed with a mini oscillating saw. The subscapularis was elevated with its insertion on osteotomized tuberculum minus. Anterior glenohumeral capsule was opened longitudinally and the humeral head with massive bony defect was visualized. The depressed articular surfaces were elevated with meticulous attention on the integrity of the fragments. On the left side, the elevated articular segment was fractured into two parts. On the right side, the elevated segment was buttressed with two lateral to medially oriented 3.5 mm cortical screws with raft screw technique used for depressed tibia plateau fractures (Figure 3). On the left side, the two fragments of the depressed articular surface was buttressed using two lateral to medially and a medial to laterally oriented 3.5 mm cortical screws. Tuberculum minus was reattached to its original place with two 3.5 mm cortical screws on both sides. The tuberculum minus and the insertion of the subscapularis tendon was reinforced using 5 mm titanium suture anchors on both sides. On intraoperative physical examination, we tested the stability of the shoulder and the fixation of the bony fragments.

Pendulum shoulder exercises were started at the third postoperative day when the soft tissue swelling subsided. The patient used shoulder sling for both shoulders for two weeks between the exercise periods. At the end of third postoperative week, rotator cuff strengthening exercises were started. At the end of sixth postoperative week, the patient had full range of motion (ROM) without instability and pain (Figure 4). The last control was at postoperative 18$^{th}$ month with completely normal physical examination and without any complaints. At this control, the constant shoulder score was 86, which was 92.4% of the age- and gender-matched population. On CT scans performed at 18$^{th}$ month control, the defect was filled with bone and the head of the humerus was protecting its anatomical spherical shape (Figure 5). An informed consent was obtained from the patient.

## DISCUSSION

In posterior shoulder dislocations, the reverse Hill-Sachs or the McLaughlin lesion is the main cause of instability. For defects less than 25% of the articular surface of the head, reduction is usually satisfactory.[6] For defects between 25-50% of the articular surface, McLaughlin subscapularis transfer to the defect or Neer modification of transfer of the tuberculum minus to the defect are recommended treatment choices.[15] For these medium sized defects, other surgical options are derotation osteotomy of the humerus and reconstruction of the head with allograft or autograft.[2,16,17] Hemiarthroplasty may be performed for large defects involving more than 50% of the head, while total shoulder arthroplasty may be performed for large defects with glenoid destruction.[18]

Subscapularis transfer, tuberculum minus transfer and derotation osteotomy are techniques which deteriorate normal anatomy and biomechanics of the

**Figure 4.** Shoulder range of motions at sixth postoperative week.

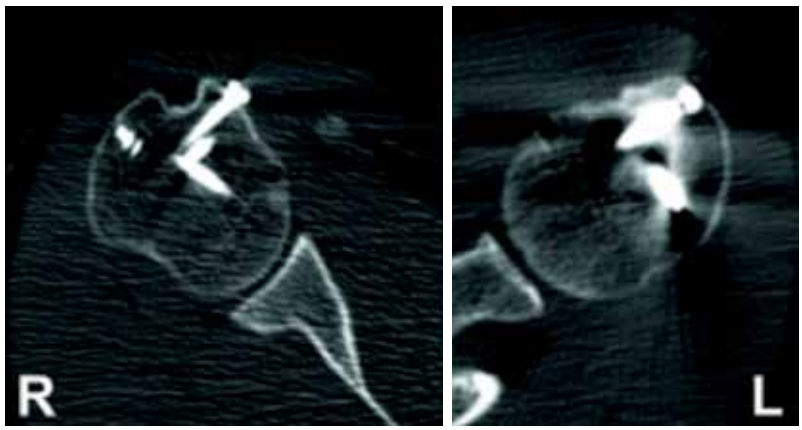


**Figure 5.** Computed tomography scans performed at 18th month control. Defect was filled with bone and head of humerus was protecting its anatomical spherical shape.

shoulder joint. In subscapularis or tubercular transfer, the insertion of the tendon is medialized which decreases excursion length of the muscle tendon unit. Buckley et al.[19] have underlined that biomechanical changes in subscapularis negatively affect the functional outcomes when compared with lesser tuberosity osteotomy in total shoulder osteotomy. Although satisfactory clinical results have been reported with modified McLaughlin technique, this biomechanical alteration may explain the loss of external and internal rotation in these series.[20,21] In addition, Hawkins et al.[5] report that, in late reconstructions and defects greater than 40% of the articular segment, subscapularis transfer may result with insufficiency, which may need shoulder joint arthroplasty. In their case series of six patients with locked posterior shoulder dislocation, Bock et al.[10] have emphasized the importance of anatomic reconstruction to restore shoulder function and stability. The anatomic and biomechanical changes created by humeral derotation osteotomy seem to be related with loss of ROM in all planes, especially in external rotation in Porteous and Miller's study.[22] In our case, although we performed a tubercular osteotomy, we securely reattached it without any anatomical and biomechanical change and obtained full ROM. Rafting technique we report here preserves the anatomic architecture of the humeral head and biomechanical properties of the musculature around the joint, which explains the almost excellent clinical outcome in our patient when compared with techniques altering shoulder joint characteristics.

Anatomic reconstruction of the reverse Hill-Sachs lesions for locked posterior shoulder dislocation with auto and allografts have been well-documented in the literature with satisfactory and encouraging results.[9,10,17,23,24] Autogenous bone grafting is a widely applied surgical technique for various orthopedic conditions. However, obtaining bone graft from iliac crest has significant morbidity. Many minor and major complications as cutaneous nerve damage, persistent pain and discomfort, infection, hematoma and seroma of the wound, arterial injury, ureteral injury, herniation, fracture, pelvic instability, cosmetic defects, hematoma and tumor transplantation have been reported in different studies.[25,26] Allografts have the risk of transmission of disease.[27] Buttressing the osteochondral fragments without any form of bone grafts reduces the risk of these complications. Biomechanical characteristics and high resistance to local depression loads for raft screw constructs and their clinical outcomes have been shown for split depression fractures of the tibial plateau.[13,14] Banerjee et.al.[24] reported satisfactory results with underpinning raft technique for reverse Hill-Sachs lesions. In contrast to our technique, they fill the void created by elevation of the osteochondral fragments with allomatrix bone graft putty before providing subchondral support with cannulated screws. However, it is biomechanically proven in tibial plateau fractures that stiffness of the raft construct does not change with addition of bone graft.[14] According to our results, we also think that rafting technique provides adequate stiffness without grafting for reverse Hill-Sachs lesions. It is obvious that raft construct does not encounter mechanical loads as tibial plateau in the shoulder region. Thus, its biomechanical stiffness and resistance to local depression of the elevated osteochondral fragment would be high enough to begin active ROM exercises as shown for our patient. This is an advantage for early rehabilitation and

enhanced functional recovery. We also demonstrated the survival of the reduction until bone healing is completed.

This study has an encouraging result for treatment of reverse Hill-Sachs lesions in posterior shoulder instability. However, it has some limitations. First of all, the number of cases should be increased to support scientific data about the technique. In addition, the technique also needs to be supported by biomechanical studies.

In conclusion, rafting technique without bone grafting may be a treatment alternative with satisfactory clinical results for medium to large sized reverse Hill-Sachs lesions of posterior shoulder dislocations.

**Declaration of conflicting interests**

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