



The results of non-surgical treatment for unstable distal radius fractures in elderly patients

İleri yaş döneminde cerrahi dışı yöntemlerle tedavi edilen radius alt uç kırıklarının sonuçları

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Amaç: Bu çalışmada yaşlı hastalarda cerrahi dışı yöntemlerle tedavi edilen instabil radius alt uç kırıklarının anatomik ve fonksiyonel sonuçları değerlendirildi.

Çalışma planı: Altmış beş yaşın üzerinde 29 hasta (7 erkek, 22 kadın; ort. yaş 72 ± 7) instabil radius alt uç kırığı nedeniyle kapalı yerleştirme ve kısa kol sirküler alçı uygulaması ile tedavi edildi. AO sınıflandırmasına göre kırıkların tümü tip C idi. Anatomik sonuçlar Stewart radyografik ölçütlerine göre değerlendirildi. İşlevsel değerlendirme Q-DASH (Quick-Disability of Arm, Shoulder and Hand) sorgulaması ile yapıldı. Hastaların kemik mineral yoğunlukları ve sağlam tarafla karşılaştırmalı olarak kavrama güçleri ve el bileğinin eklem hareketleri ölçüldü. Ortalama takip süresi sekiz ay (dağılım 6-12 ay) idi.

Sonuçlar: Kırıkların tümü ortalama 4 ± 1 hafta içinde kaynadı. Yirmi iki hastanın (%75.9) kemik mineral yoğunluğu ölçümlerinde osteoporoz saptandı. Kemik morfolojik indeksi ölçümünde ise 26 hastada (%89.7) bölgesel osteoporoz bulundu. Tedavi sonrasında radius tilt açısı $+5.6\pm5.4^\circ$, inklinasyon açısı $17\pm4.6^\circ$, radius yüksekliği 9 ± 2.3 mm, ulnar varyans pozitifliği ise 2.8 ± 2 mm ölçüldü. Beş hastada (%17.2) radius eklem yüzünde 1 mm'yi geçmeyen basamaklanma saptandı. Stewart değerlendirme ölçütlerine göre, 15 hastada (%51.7) iyi, 12 hastada (%41.4) orta, iki hastada (%6.9) ise kötü sonuç alındı. Q-DASH puanı üçüncü ayda 38 ± 19.2 , son kontrolde ise 23 ± 2.4 bulundu. Kırık taraf el bileğinin kavrama kuvveti sağlam tarafın $\%57.3\pm12.5$ 'ine, ekstansiyon/fleksiyon hareket açıklığı sağlam tarafın $\%52\pm14$ 'üne, pronasyon/supinasyon hareket açıklığı ise $\%75\pm16$ 'üne geriledi. On bir hastada (%37.9) komplikasyon görüldü. Üç hastada (%10.3) kötü kaynama gelişti ve düzeltici osteotomi ile tedavi edildi.

Çıkarımlar: Yaşlı hastaların cerrahi riskleri ve sınırlı tedavi beklentileri göz önüne alındığında, instabil radius alt uç kırıkları kapalı yerleştirme ve kısa kol alçı ile tedavi edilebilir.

Anahtar sözcükler: Yaşlılık; Colles kırığı; kırık fiksasyonu, internal; osteoporoz /komplikasyon; radius kırığı/televatı.

Objectives: This study was designed to evaluate anatomical and functional results of non-surgical treatment for unstable distal radius fractures in the elderly.

Methods: Twenty-nine patients (7 males, 22 females; mean age 72 ± 2 years) aged ≥ 65 years were treated with closed reduction and short-arm circular casting for unstable distal radius fractures. According to the AO classification, all patients had type C fractures. Anatomical and functional results were assessed using the Stewart criteria and Q-DASH (Quick-Disability of Arm, Shoulder and Hand) questionnaire, respectively. Bone mineral density measurements were performed. Grip strength and wrist range of motion were measured in comparison to the unaffected side. The mean follow-up was eight months (range 6 to 12 months).

Results: Union was achieved in all fractures within a mean of 4 ± 1 weeks. Bone mineral density measurements showed osteoporosis in 22 patients (75.9%), and 26 patients (89.7%) had regional osteoporosis in cortical width measurements. After treatment, radiographic measurements showed the following: radius tilt angle $+5.6\pm5.4^\circ$, inclination angle $17\pm4.6^\circ$, radial height 9 ± 2.3 mm, and positive ulnar variance 2.8 ± 2 mm. Five patients (17.2%) exhibited an articular step-off of less than 1 mm on the radial surface. According to the Stewart criteria, the results were good in 15 patients (51.7%), moderate in 12 patients (41.4%), and poor in two patients (6.9%). The mean Q-DASH score was 38 ± 19.2 at three months, and 23 ± 2.4 at final follow-up. Grip strength, extension/flexion, and pronation/supination were measured as $57.3\pm12.5\%$, $52\pm14\%$, and $75\pm16\%$ of the unaffected side, respectively. Complications were seen in 11 patients (37.9%). Three patients (10.3%) developed malunion which required corrective osteotomy.

Conclusion: Unstable distal radius fractures can be treated with closed reduction and cast application in low-demand elderly patients to avoid risks and complications of surgery.

Key words: Aged; Colles' fracture/rehabilitation; fracture fixation, internal; osteoporosis/complications; radius fractures/therapy.

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Distal radius fractures are commonly seen especially among elderly women.^[1] As a consequence of such fractures that are usually due to accidental falling, pain as well as movement constraints and malformations may be seen.^[2-5] In the treatment of further debilitating illness of the limited lives and expectations of elderly patients, numerous factors should be considered. Regional variable such as instability of fracture, the intraarticular extension and quality of bone tissues as well as the general medical condition of patient are determinants of the treatment. Furthermore, the significant relationship between recovery of anatomical integrity and functionality is uncertain in elderly patients contrary to younger ones.^[1-4] For this reason, nonsurgical methods are used to treat elderly patients whereas surgical methods are often preferred to ensure anatomical realignment of unstable intraarticular fractures in younger patients. However, painless recovery of wrist functionality among elderly is as important as younger patients.^[1-11]

In this prospective study, we aimed to determine the outcomes as well as related systemic and regional factors influencing the results of nonsurgical methods used to treat unstable distal radius fractures.

Patients and methods

29 (7 male, 22 female average age 72 ± 7 yr) patients with unstable distal radius fracture, who were treated with nonsurgical methods in our clinics between 2006 and 2008 were included. Inclusion criteria were a) 65 years or older, b) meeting the instability criteria for radius distal fractures (tilt angle at volar direction is 25° ; angulation at dorsal direction is more than 10° ; stepping on the articular facet is more than 2 mm; radial shortening is more than 5 mm and or dorsal break, c) demonstrating acceptable fracture realignment after closed reduction, were considered eligible.^[12] Fractures were on the dominant side in 11 (38%) patients. All fractures were type C (C1: 13, C2: 14, C3:2) according to AO classification (Table 1). All fractures were due to falling, with $19.2^\circ \pm 7.3^\circ$ dorsal angulation. Closed reduction was conducted to all patients upon their informed consent, in the emergency room. Neither general nor regional anesthesia was not given to any of those patients during the intervention. For those who stated intolerance for pain, Diclofenac sodium or Metamisole sodium was administered intramuscularly for analgesia before reduction. After the closed reduction maneuver, short-arm circular casting

was made starting from metacarpophalangeal joints to elbow. Wrist position was fixed at flexion by 30° , ulnar deviation by 10° and pronation by 60° . Alignment was evaluated after comparative front, back and side X-ray graphics. Elevation was advised for patients to control edema. Patients were informed about the complications of casting and compartment syndrome, and then invited for control visit a day after. X-rays for control were repeated at day 2 and 7. Physical examinations after removal of cast were implemented by the end of week 4 (Figures 1, 2). Patients were trained about isotonic and isometric exercises for wrist, fingers and elbow. For every quarter after then, patients were called for control visits. Anatomical findings were evaluated in reference to Stewart radiological criteria. For functional assessment, Q-DASH (Quick-Disability of the Arm, Shoulder and Hand) rating scale was used starting from the 3rd month of the treatment. By using Q-DASH, 11 different daily functionality of the patients were scored between 1 to 5.^[13] Increase in scores were interpreted as increase in the severity of functional problems. Bone mineral density (BMD) was measured by using a double beam X-ray absorption technique (DEXA, Lunar DPX-IQ (GE Lunar Corp, Madison, WI). BMD readings were evaluated in reference to World Osteoporosis Foundation (WOF) classifications. Measurements that yields a T score for hip and spine regions between 1.5 and 2.5 were concluded as osteopenia and those above 2.5 were considered as osteoporosis.^[14,15] Additionally, regional osteoporosis and bone morphological index (BMI) findings were evaluated. This evaluation is made by subtracting the sum of internal bone cortex thicknesses measured at the mid line of 2. Metacarp diaphysis by using AP radiography, from the distances between external cortexes, This values below 4.17 mm for 60-70 years old patients and 2.79 mm for those older than 70 were considered as osteoporosis.^[15] Joint movements were measured by using a standard goniometer and the proportional evaluation was made in reference to the healthy side. Grasping forces of the wrist were measured in comparison to the healthy side (Sammons Preston Inc, Bolingbrook, IL).

Statistical analyses of the findings were made by using SPSS version 11.5 software. Cross control tables were evaluated by Pearson's test and non-parametric tables were analyzed with Wilcoxon signed-rank test.

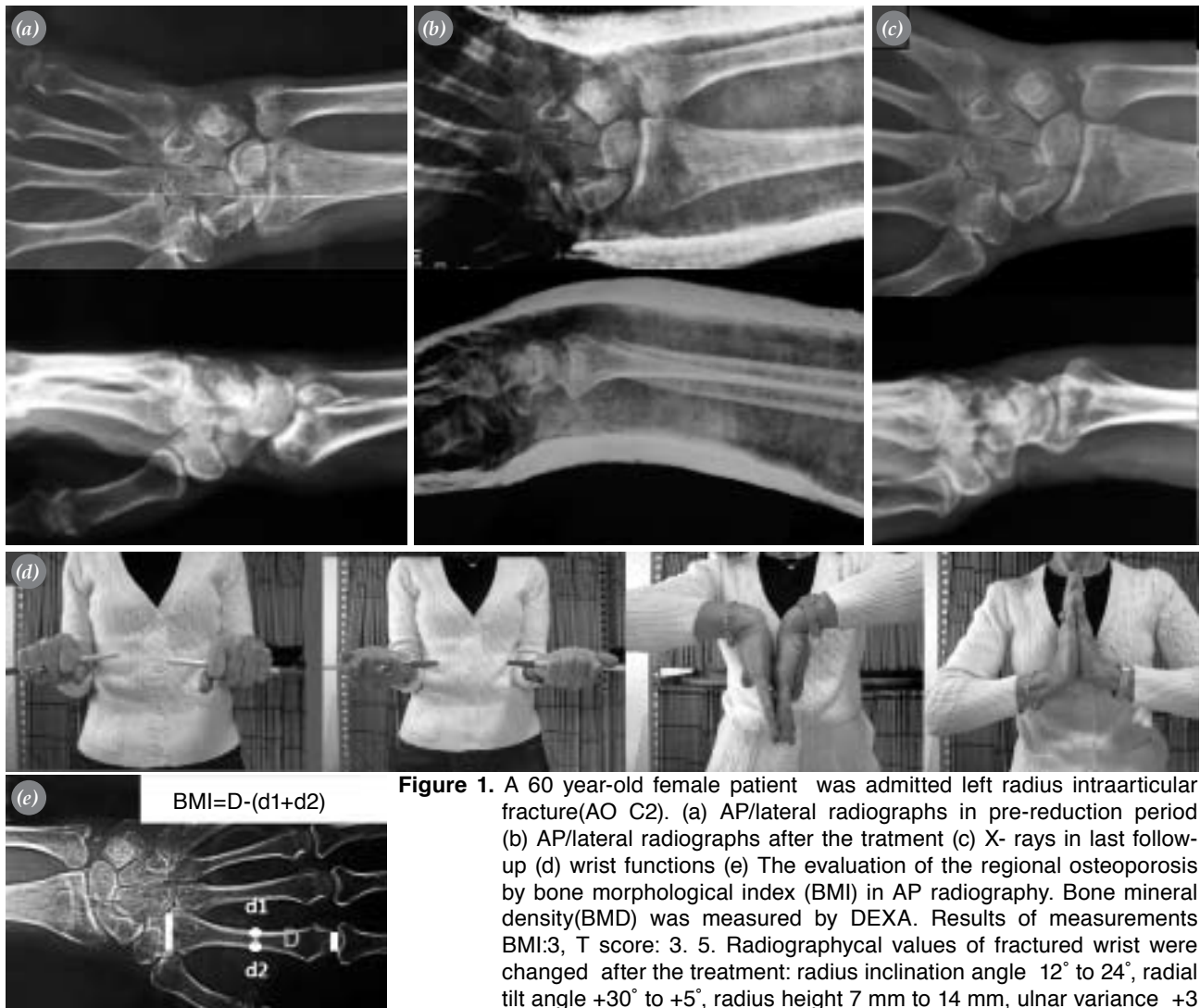


Figure 1. A 60 year-old female patient was admitted left radius intraarticular fracture(AO C2). (a) AP/lateral radiographs in pre-reduction period (b) AP/lateral radiographs after the treatment (c) X- rays in last follow-up (d) wrist functions (e) The evaluation of the regional osteoporosis by bone morphological index (BMI) in AP radiography. Bone mineral density(BMD) was measured by DEXA. Results of measurements BMI:3, T score: 3. 5. Radiographycal values of fractured wrist were changed after the treatment: radius inclination angle 12° to 24°, radial tilt angle +30° to +5°, radius height 7 mm to 14 mm, ulnar variance +3 mm ve neutral. Results of stewart rating scale and DASH scores respectively 3 and 4. 5 points.

Results

Patients were followed up for 8 (rank, 6-12) months. Fractures were all recovered clinically in 4 ±1 week. Within the first 2 weeks, >5° dorsal inclination in the radial tilt angle and/or > 2 mm positive changes in the ulnar variance were recorded in 8 (27.6%) patients. Such loss of reductions were treated either by rereduction and casting. 22 (75.9%) patients were diagnosed to have osteoporosis in relevance to low bone density. Only 3 (10.3%) patients were using medications preventing bone degradation for the treatment osteoporosis. Bone morphological index measurements made on the 2. metacarpal diaphysis revealed that 26 patients (89.7%) had regional osteoporosis.

Radiological measurement results of both sides are demonstrated (before and after the treatment) in [table 1]. >1 mm articular step off was recorded in five (17.2%) patients. 15 (51.7%) patients were good, 12 (41.4%) patients were moderate and 2 (6.9%) patients were bad in reference Steward Criteria. Q-DASH scores were 38±19.2 and 23±2.4 for 3rd month and last follow-up, respectively. Grasping forces were measured as 27±1 kg for healthy side and 11.5±1.8 kg for fractured side. The loss of grasping forces was calculated as 57%±12.5 for the fractured side. As a percentage of the healthy side, extension/flexion movement was 52%±14 and pronation/supination movement clearance was 75%±16.

Table 1. Radiological data

	healty side	fractured side (initial)	fractured side (last follow-up)
Radial inclination (°)	25.0±3.5	14.0±4.0	17.0±4.6
Volar tilt (°)	-3.6±4.0	+19.2±7.3	+5.6±5.4
Radial height (mm)	14.0±1.0	8.6±3.0	9.2±2.3
Ulnar variance (mm)	0±0.5	5.4±4.0	2.8±2.0

Statistical evaluation

Wilcoxon ranked-sign test

- Volar tilting and inclination angles as well as heights of the fractured radius was significantly different than the healthy side ($p < 0.05$).

- Post-treatment findings were suggesting healing while the difference between measured values and angles of healthy wrist, except radial tilting were statistically significant ($p < 0.05$).

Pearson correlation test

- There was a good level of negative correlation between radial inclination and bone morphological index, after the treatment ($r: -0.6$; $p < 0.05$).

- There was a good level of correlation between age and ulnar variance positivity ($r: 0.82$; $p < 0.05$).

- A week to moderate correlation between grasping power and post-treatment inclination angle was recorded ($r: 0.25$; $p < 0.05$).

- Also a week to moderate correlation between grasping power and bone mineral density was recorded ($r: -0.32$; $p < 0.05$).

- When compared, there was a week to moderate correlation between Stewart and Q-DASH scores ($r: 0.3$; $p < 0.05$).

- A week to moderate negative correlation was recorded between movement clearance on sagittal plane (extension/flexion) as well as forearm rotations (pronation/supination) and DASH scores at the endpoint ($r: -0.3$; $r: -0.2$; $p < 0.05$) in comparison to healthy side.

Miscellaneous complications were seen in eleven (38%) patients. Of those, eight (27.6%) patients had a loss in fracture alignment, one (3.4%) had complex regional pain syndrome (RSD) and two (6.9%) had dermatological problems due to casting. Fractures

with alignment loss were treated by secondary realignment within the first two weeks of the treatment. Malunion developed in 3 (10.3%) patients were treated by corrective osteotomy. The patient with complex regional pain syndrome was given Calcitonin together with special physical therapy program. Moreover, patients with a T score above 2.5, who were not under osteoporosis treatment, were started with Alendronate and Calcium-Vitamin D combination therapy.

Discussion

There are few studies about the consequences of distal radius fractures, a frequently seen case among elderly.^[2-4, 8-11, 17-22] However, the number of elderly people with independent daily functioning is increasing every day. Our first finding of the study was that, systemic illnesses and primarily osteoporosis have negative impact on the treatment outcomes especially among female patients.^[7,10]

Through recent years, primary stability problems of surgical implementations have been decreased remarkably by the improvements in plating systems as well as the introduction of new synthetic grafts. As a result of those developments, the treatment of unstable distal radius fractures with open reduction and fixing plates has been widely adopted.^[1, 17] Results of those procedures are promising in the elderly patients. Though the radiological correction recorded in the elderly was limited in comparison to the other age groups, results are pretty successful.^[1,6,7,14,17] In consideration of low level expectations of elderly individuals, risks associated with anesthesia and treatment costs, non-surgical therapies are still a valid option.^[2, 4-6, 8,17-21] Partial recovery of wrist functionalities in mid-long term is possible for closed reduction and fixation by casting^[20]. Despite all those developments in therapy, there is still a lack of an established treatment algorithm for distal radius fractures in the elderly.^[1-3, 19-21] In our study, 52% of unstable distal radius fractures included, were treated successfully. Besides, 90% of

the patients stated their satisfaction about functionality.

While the reduced bone mineral density and age were influencing anatomical outcomes, reduced grasping power and movement constraints were affecting functional outcomes, negatively.^[14, 20-22] Moreover, limitations both in wrist movements on sagittal plane as well as rotation of forearm were found to be adversely affecting the daily functions. It was also observed that, functional limitations occurred after formation of fracture, have been improving through the course of follow up.^[6]

Loss of the reduction in the early stage is the most frequently seen problem associated with the treatment of wrist fractures conservatively.^[11,6,17,23,24] This early stage complication that is reported to have a prevalence varying between 42% and 89% was seen in 30% of our patients. We attributed this percentage to the early intervention following trauma. Also, it should be noted that the average age of the patients in other studies were more than it was in our study.^[23]

Predictability of expected functional outcomes for distal radius fractures in the elderly is another particular issue.^[14, 18, 22-24] Osteoporosis and reduced grasping forces influenced daily functioning and patient satisfaction adversely also in the post-treatment phase. In conjunction with this matter, we suggest to have bone mineral density and grasping forces of the healthy side measured.

The most significant limitations of our study was short follow up period and lack of a control group.

As a result, taking into account the surgical risks specific for elderly patients and limited expectations of relevant therapies, unstable distal radius fractures could be treated by closed reduction and short arm casting. Especially tilting angle and all other joint angles as well as radial length can be corrected sufficiently by a successful closed reduction and casting. A partial arrangement of anatomical alignment can lead to satisfying functional outcomes. Age, bone mineral density, grasping forces and sex can be listed as the factors influencing the functional consequences of wrist fractures seen in the elderly patients.

References

- Chen NC, Jupiter JB. Management of distal radial fractures. *J Bone Joint Surg [Am]* 2007;89:2051-62.
- Fujii K, Henmi T, Kanematsu Y, Mishiro T, Sakai T, Terai T. Fractures of the distal end of radius in elderly patients: a comparative study of anatomical and functional results. *J Orthop Surg* 2002;10:9-15.
- Karalezli K, Demir R, İltar S, Çakır A, Karalezli N, Özeri Z. Radius distal uç kırıklarında konservatif tedavi sonuçlarımız. *Gülhane Tıp Dergisi* 2004;46:315-22.
- McQueen M, Caspers J. Colles fracture: does the anatomical result affect the final function? *J Bone Joint Surg [Br]* 1988;70:649-51.
- Roumen RM, Hesp WL, Bruggink ED. Unstable Colles' fractures in elderly patients. A randomised trial of external fixation for redisplacement. *J Bone Joint Surg [Br]* 1991; 73:307-11.
- Gehrmann SV, Windolf J, Kaufmann RA. Distal radius fracture management in elderly patients: a literature review. *J Hand Surg [Am]* 2008;33:421-9.
- Arora R, Lutz M, Fritz D, Zimmermann R, Oberladstätter J, Gabl M. Palmar locking plate for treatment of unstable dorsal dislocated distal radius fractures. *Arch Orthop Trauma Surg* 2005;125:399-404.
- Beumer A, McQueen MM. Fractures of the distal radius in low-demand elderly patients: closed reduction of no value in 53 of 60 wrists. *Acta Orthop Scand* 2003;74:98-100.
- Davis TR, Buchanan JM. A controlled prospective study of early mobilization of minimally displaced fractures of the distal radial metaphysis. *Injury* 1987;18:283-5.
- Altissimi M, Antenucci R, Fiacca C, Mancini GB. Long-term results of conservative treatment of fractures of the distal radius. *Clin Orthop Relat Res* 1986;(206):202-10.
- Vural O, Okçu G, Özalp RT, Akkaya MG, Yercan HS. Kolles kırığı tedavisinde kapalı redüksiyon alçılı tespit ile Kapandji yönteminin karşılaştırılması. *Eklemler Hastalıkları ve Cerrahisi* 2008;19:55-60.
- Makhni EC, Ewald TJ, Kelly S, Day CS. Effect of patient age on the radiographic outcomes of distal radius fractures subject to nonoperative treatment. *J Hand Surg [Am]* 2008;33:1301-8.
- Stewart HD, Innes AR, Burke FD. Factors affecting the outcome of Colles' fracture: an anatomical and functional study. *Injury* 1985;16:289-95.
- Institute for Work & Health's (IWH) [Internet]. Quick-DASH; Available from: http://www.dash.iwh.on.ca/assets/images/pdfs/quickdash_q06.pdf.
- Hollevoet N, Verdonk R. Outcome of distal radius fractures in relation to bone mineral density. *Acta Orthop Belg* 2003;69:510-4.
- Gümüşer FG, Gökten C, Cerrahoğlu L, Gülgün Yılmaz G, Duruöz MT. Postmenopozal olgularda metakarpal indeksi ile kemik dansitesi arasındaki ilişki. *Türk J Nucl Med* 2003;12:119-23.
- Nijs S, Broos PL. Fractures of the distal radius: a contemporary approach. *Acta Chir Belg* 2004;104:401-12.
- Young BT, Rayan GM. Outcome following nonoperative

- treatment of displaced distal radius fractures in low-demand patients older than 60 years. *J Hand Surg [Am]* 2000; 25:19-28.
19. Azzopardi T, Ehrendorfer S, Coulton T, Abela M. Unstable extra-articular fractures of the distal radius: a prospective, randomised study of immobilisation in a cast versus supplementary percutaneous pinning. *J Bone Joint Surg [Br]* 2005;87:837-40.
 20. Handoll HH, Madhok R. Surgical interventions for treating distal radial fractures in adults. *Cochrane Database Syst Rev* 2003;(3):CD003209.
 21. Hegeman JH, Oskam J, van der Palen J, Ten Duis HJ, Vierhout PA. The distal radial fracture in elderly women and the bone mineral density of the lumbar spine and hip. *J Hand Surg [Br]* 2004;29:473-6.
 22. Nesbitt KS, Failla JM, Les C. Assessment of instability factors in adult distal radius fractures. *J Hand Surg [Am]* 2004;29:1128-38.
 23. Mackenney PJ, McQueen MM, Elton R. Prediction of instability in distal radial fractures. *J Bone Joint Surg [Am]* 2006;88:1944-51.
 24. Gdemez E, Ekioęlu F, zcan G, Sepici B. Yalı hastaların distal radius kırıklarının cerrahi olmayan yntemle tedavisi sonrası grlen komplikasyonlar. *Artroplastik Artroskopik Cerrahi* 2001;12:144-8.