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ARAŞTIRMA / RESEARCH

Is arthroscopic intervention-assisted fragment-specific fixation technique superior to volar plating in distal radius fractures involving the middle column?

Orta kolonu ilgilendiren distal radius kırıklarında artroskopik destekli fragman spesifik fiksasyon standart volar plak ile fiksasyona göre üstün müdür?

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Abstract

Purpose: In this study, the clinical and radiological results of volar plating and arthroscopic intervention-assisted fragment-specific fixation techniques used in patients operated for AO Type B-C distal radius fracture in which the medial colon is affected were compared.

Materials and Methods: X-ray and clinical records of 98 patients who underwent surgical treatment for radius distal end (DER) fracture between April 2011 and January 2017. The patient groups treated with arthroscopy-assisted fragment-oriented fixation (Group A) and plate screw fixation with a volar approach without arthroscopic intervention (Group B) were compared in terms of joint range of motion, grip strength, and clinical scores. Flexion and extension, ulnar deviation, radial deviation, pronation, and supination angles measured with a standard goniometer were recorded in the joint range of motion measurement. Grip strength was measured with a Jamar dynamometer for power measurement. DASH score was used in clinical evaluation.

Results: When the operated wrists of both patient groups were compared, there was no significant difference between the DASH score, grip strength, palmar flexion, and pronation angles of motion. A statistically significant difference was observed between the mean dorsiflexion angles of 55 degrees in group A and 44 degrees in group B, mean radial deviation angles of 25 and 19 degrees, and the mean supination angles of 87 and 80 degrees, respectively.

Öz

Amaç: Bu çalışmada, medial kolonun etkilendiği AO Tip B-C distal radius kırığı nedeniyle ameliyat edilen hastalarda kullanılan volar plaklama ve artroskopik müdahale destekli fragmana özgü tespit tekniklerinin klinik ve radyolojik sonuçlarını karşılaştırıldı.

Gereç ve Yöntem: Nisan 2011 ile Ocak 2017 arasında radius distal uç (DER) kırığı nedeniyle cerrahi tedavi uygulanan 98 hastanın röntgen ve klinik kayıtları geriye dönük analiz edildi. Artroskopi destekli fragmana yönelik tespit ile tedavi edilen(Grup A), artroskopik müdahale olmaksızın volar yaklaşımla plak vida fiksasyonu uygulanan (Grup B) hasta grupları eklem hareket açıklıkları, kavrama güçleri klinik skorlar açısından karşılaştırıldı. Eklem hareket açıklığı ölçümünde standart gonyometre ile ölçülen fleksiyon ve ekstansiyon, ulnar deviasyon, radyal deviasyon, pronasyon, supinasyon açıları kaydedildi. Güç ölçümü için Jamar dinamometre ile kavrama kuvveti ölçüldü. Klinik değerlendirmede DASH skoru kullanıldı.

Bulgular: Her iki hasta grubunun ameliyatlı bilekleri karşılaştırıldığında DASH skoru, kavrama kuvvetleri, palmar fleksiyon ve pronasyon hareket açıları ortalamaları arasında anlamlı fark görülmedi. Sırasıyla A grubunda ortalama 55 derece ve B grubunda ortalama 44 derece ölçülen dorsifleksiyon açıları, 25 ve 19 derece ölçülen ortalama radial deviasyon açıları, 87 ve 80 derece ölçülen ortalama supinasyon açıları arasında istatistiksel olarak anlamlı farklılık gözlendi.

Sonuç: Eklem içi distal radius kırıklı hastalarda, artroskopik yardımlı fragman spesifik fiksasyon teknik

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Conclusion: Although arthroscopic-assisted fragment-specific fixation is technically a laborious procedure that requires a learning curve in patients with intra-articular distal radius fractures, it may be beneficial to provide better postoperative results, especially in young patients with high range of motion expectations.
Keywords:. Distal radius fracture, wrist arthroscopy, fragment specific fixation, volar plating

olarak, öğrenme eğrisi gerektiren zahmetli bir işlem olmasına rağmen, özellikle genç ve yüksek eklem hareket açıklığı beklentisi olan hastalarda daha iyi postoperatif sonuçlar sağlamak adına faydalı olabilir.

Anahtar kelimeler: Distal radius kırıkları, el bilek artroskopisi, fragman spesifik tespit, volar plaklama

INTRODUCTION

Understanding essential principles in managing intraarticular distal radius fracture is the key to successfully treating this common problem. It is influenced by precise diagnosis, understanding of exact fracture configuration, and extent of soft tissue injury. Along with the anatomic restoration of the articular surface, the maximum reorganization of the entire anatomy, and the fixation of the fracture with appropriate orthopedic materials[1]. By fulfilling these criteria, excellent to good clinical and functional outcomes can be attained. Furthermore, associated complications can be minimized.

In planning distal radius fracture management, fracture pattern is a guide for treatment and prognosis. Current classifications of distal radius fractures are three column[2] and The Arbeitsgemeinschaft für Osteosynthesefragen(AO)[3] classifications.

Medial column fractures of the distal end radius consist of the volar rim, dorsal wall, dorsal ulnar corner (DUC), and free intraarticular fragments. Restoring articular surface volar tilt, lunate fossa, and the sigmoid notch is critical for surgical management of this common problem[4]. The dorsal wall provides constraint to dorsal subluxation of the carpus by providing attachment for the dorsal radiocarpal ligament. In addition, the DUC fragment provides an attachment site for the dorsal distal radioulnar ligament. In contrast, this structure is frequently displaced to the proximal, ulnar, and dorsal sides in the fractures of this region[5].

Although good results are known in the literature with volar plating, which allows screwing to all columns in the fixation of intra-articular distal radius fractures that classically concern the middle column, the quality of intra-articular reduction is indirectly evaluated with fluoroscopy in this approach[1-4].

Appropriate assessment of intra-articular reduction using fluoroscopy may be misleading compared with arthroscopy for plate and screw osteosynthesis techniques performed with a volar approach for fractures of the distal radius[6,7]. Some fracture patterns may not be suitable for volar plating[8]. Non-anatomic intra-articular reduction is a significant risk factor for chronic pain, limitation of motion, wrist instability, and radiocarpal osteoarthritis[9]. For this reason, arthroscopic procedures[10,11] and fragment-specific fixations[1,12] recently being popular.

This study compared the clinical and radiographic outcomes of volar plating and arthroscopic intervention with fragment-specific fixation techniques in patients that operated for medial column affected distal radius fracture of the AO type B and C.

In the literature, articles comparing the clinical and radiological results of volar plating and arthroscopy-assisted fragment-specific fixation[12,13]. However, an article comparing both techniques among fractures involving only the middle column is not available in the literature as far as we know. Therefore, we hypothesized that arthroscopic evaluation of intra-articular reduction quality in patients with intra-articular distal radius fractures involving the middle column and fixation that would not affect the complex anatomy in other compartments to be applied for the fragment was superior to standard volar plating in terms of joint range of motion, hand grip strength, and clinical scores.

MATERIALS AND METHODS

The study was carried out with the permission of the Gaziosmanpaşa Training and Research Hospital Clinical Research Ethics Committee (Date: 22.12.2021, Decision No: 386).

Sample

In our study, the data of 389 patients operated on for distal radius fracture in Gaziosmanpaşa Training and Research Hospital (Before 2013, Taksim Training

and Research Hospital) Orthopedics and Traumatology clinic between April 2011 and January 2017 were scanned retrospectively from hospital records. Out of 98 patients with type B and C according to the AO classification concerning the middle colon, 22 patients under the age of 18 and over the age of 65 were excluded from the study. In addition, patients with incomplete follow-up (12), additional trauma (except scaphoid, scapholunate ligament, and TFCC)(10), previous index limb injuries(5), and systemic diseases such as rheumatoid arthritis(4) were excluded.

Patients aged 18 to 65 years with fractures in groups B and C according to the AO classification, with involvement of the medial column according to the three-column classification, and complete follow-up 45 patients were included in the study.

According to surgical methods, patients were divided into two groups. In group A (17 patients; including 14 patients AO type B and three patients AO type C), arthroscopically assisted fragment-specific plate osteosynthesis was performed, in group B (28 patients; including 17 patients AO type B and 11 patients AO type C), a volar locking plate was used.

In the sample G* Power 3.010 program, the effect size was calculated using 0.8 first type error 0.05 and power 0.8. Therefore, 26 for each group were determined as 52 patients in total. However, due to the low number of patients treated with the arthroscopically supported fragment-specific surgical method, the lack of controls in these patients, and the inability to be included in the study, 17 patients were included in the 'Group A' study.

Clinical assessment included a range of motion and handgrip strength measurements with a dynamometer. A standard goniometer measured for wrist movements, flexion and extension, ulnar deviation, radial deviation, pronation, and supination. A 'Jamar' hand dynamometer was used for grip strength as described by the American Society of Hand therapists[13]. Patients were also assessed with the Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)[14]. The unaffected and operated wrist joint movements were compared in both groups using a standard goniometer. In addition, radiological data, joint range of motion (Figure 1), results of DASH and grip strengths, and complications encountered were compared between the two groups. Two different surgeons evaluated the radiological and clinical outcomes.

Figure 1. Fragment-specific fixation functional results.

Surgical technique

Group A: Arthroscopic-assisted fragment-specific osteosynthesis

An underwent arthroscopy of the wrist after opting for fragment-specific fixation. Arthroscopically, 3-4, 6R, and portals were standard. Additionally, a 1-2 portal was used in cases with radial colon pathology and a 6U portal in patients who would undergo TFCC repair. In each case, the joint was inflated with ten ccs of saline, and a dry arthroscopy was performed using a 30^{0} scope (Figure 2). The components of the damaged soft tissue were

intervened with arthroscopy, and the soft tissue damage of the wrist and intra-articular fragment excision. After the affected region was identified and the fracture was fixed with a fragment-specific plate (Trimed Volar Hook Plate, Dorsal Hook Plate, Radial Column Pin Plate) that was anatomically matched to this region (Figure 3), the avulsion at the fracture line and the possible intra-articular free fragments were controlled arthroscopically.

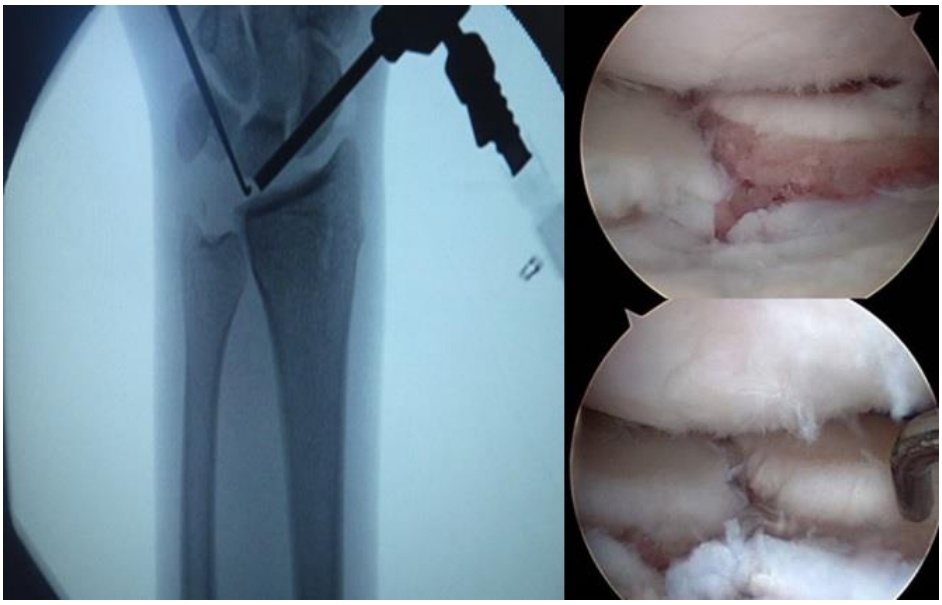

Figure 2. Wrist arthroscopy; fluoroscopy and scope image.

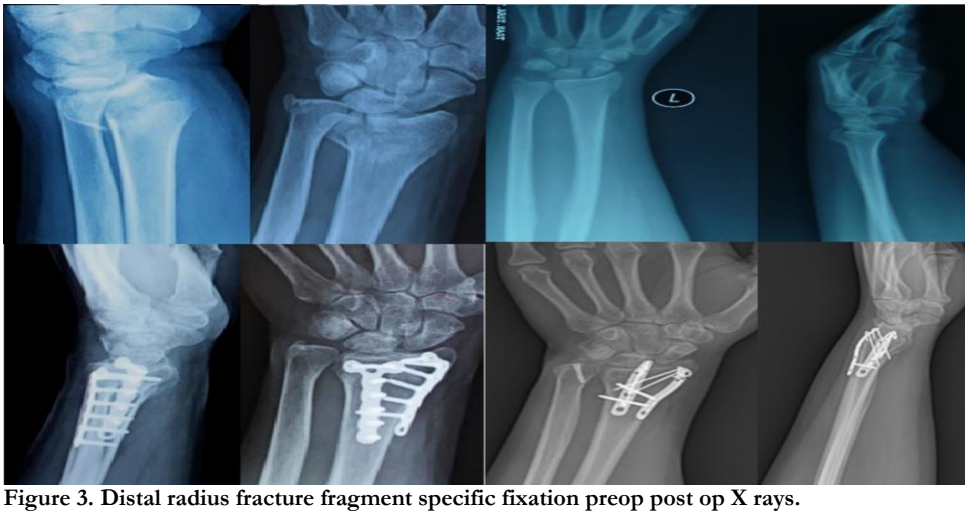

Figure 3. Distal radius fracture fragment specific fixation preop post op X rays.

Group B: Volar plating

The patients in group B applied plate and screw osteosynthesis using a volar approach. The step-off and pathologies in the joint were checked by fluoroscopy.

Rehabilitation

In both groups, finger movements were started on the same day by applying a resting splint (short arm) until the stitches were removed after the operation. At the latest, on the 15th day, the splint was removed, and passive and active wrist movements were started as tolerated. Weight-bearing and axial loading are not allowed until the third month. Elbow movements have not been restricted since the beginning of the postoperative period. The patients excluded from this process were those who underwent TFCC repair, and a splint or splint fixation was extended to the 45th day in this group. Rehabilitation was applied as passive and then active movements after the 45th day.

Statistical analysis

A normality control was performed by the Shapiro-Wilk test, Histogram, Q-Q plot, and boxplot graphs for the statistical evaluation of data. The normality was provided by the transformation of the non-normal distributed variables. Data were given as mean, standard deviation, median, minimum, maximum, frequency, and percentage.

Wilcoxon test to evaluate variables such as volar tilt, Radial Inclination, Radial Height (Table 1), Mann Whitney U test for variables such as Flexion-Extension, Radial deviation- Ulnar deviation, Pronation- Supination, Grip strength, Score of DASH questionnaire (Table 2) used.

Chisquare test with Yates correction was used to evaluate the bias-variance between the groups. The significance limit was taken as $p < 0.05$ and two-sided. The analyzes were performed using NCSS 10 (2015. Kaysville, Utah, USA) software program.

RESULTS

A total of forty-five (45) patients fulfilled the inclusion criteria. The mean age for Group A was 41.6 years (range 18 - 65), follow-up time was 20.3 months (range 6-70), volar tilt was 10° (range7-18), the radial inclination was 19.4° (range 15-24), and the radial height was 12.4 mm (range 10-16) (Table 1). Among the patients in this group, the right side of 11 (64.7%) was affected, and the left side of 6 (35.3) was affected. In addition, the dominant hand of 8 (47%) patients was affected.

In the patients in group A, for the operated wrist, the mean palmar flexion was 65° (range 40-80), dorsiflexion was 54.7° (range 35-64), the ulnar deviation was 30.2° (range 20-40), radial deviation was 25.12° (range 15-35), pronation was 84.7° (range 75-90), supination was 87.3° (range 80-90), whereas, for the unaffected wrists, the mean palmar flexion was 68.2° (range 45-80), dorsiflexion was 57.6° (range 35-65), the ulnar deviation was 32.4° (range 20-40), radial deviation was 27.3° (range 15-35), pronation was 86.4° (range 75-90), supination was 87.2° (range 85-90), grip strength was 21 (8-37), and DASH score was 5 (0-22) (Table 2).

The mean age for Group B was 40.7 years (range 18 -64), follow-up time was 18.6 months (range 6-72), volar tilt was 11.6° (range7-23), the radial inclination was 20.9° (range 11-25), and the radial height was 12.6 mm (range 8-18) (Table 1). Among the patients in this group, the right hand of 11 (39.3%) was affected, and the left of 17 (60.7%) was affected. In addition, the dominant hand of 17 (60%) patients was affected.

In the patients in group B, for the operated wrist, the mean palmar flexion was 62.2° (distribution 40-90), dorsiflexion was 43.7° (range 20-70), the ulnar deviation was 30.3° (range 15-40), radial deviation was 18.7° (range 10-40), pronation was 78° (range 30-90), supination was 79.6° (range 45-90), for the unaffected wrists, the mean palmar flexion was 70.7° (range 55-90), dorsiflexion was 53.7° (range 25-75), the ulnar deviation was 34.7° (range 20-45), radial deviation was 23.3° (range 15-45), pronation was 82.6° (range 60-90), supination was 85.8° (range 80-90), grip strength was 27 (10-46), and DAHS score was 13 (0-72) (Table 2).

According to AO classification, 2 (11.8%) of the patients in A group were classified as 23B1, 9 (52.9) as 23B2, 3 (17.6%) as 23B3, and 3(17.6%) as 23C2. In the group B, 1 (3.6%) of the patients was classified as 23B1, 4 (14.3%) as 23B2, 12 (42.9%) as 23B3, 2 (7.1%) as 23C1, 7 (25%) as 23C2, and 2 (7.1%) as 23C3. When the patients in groups A and B were compared for age, follow-up time, DASH score, and radiological parameters, it was seen that there was no statistically significant difference in terms of age (p:0.85), follow-up time (p:0.9), radial inclination (p:0.21), radial height (p:0.70), and volar tilt (p:0.79). In addition, there was no significant difference (p:0.6) between the two groups regarding the DASH score.

Table 1. Distribution of radiological measurements of patients by groups

	Group A(n:17)	**Group B(n:28)**	**Between-groups comparison**
	Mean(Distribution)	Mean(Distribution)	P value (p<0.05)
Volar tilt(°)	10(7-18)	11.6(7-23)	0.79
Radial inclination(°)	19.4(15-24)	20.9(11-25)	0.21
Radial Height(mm), distribution	12.4(10-16)	12.6(8-18)	0.7

*mm: millimeters

Table 2. Distribution of patient's wrist functions by groups

	Group A		**Within-group comparison**	**Group B**		**Within-group comparison**	**Between-groups comparison**
	Operated side, Mean(Range)	Unaffected side Mean(Range	P value (p<0.05)	Operated side Mean(Distribution)	Unaffected side Mean(Distribution)	P value (p<0.05)	P value (p<0.05)
Flexion of the wrist (°)	65(40-80)	68(45-80)	0.009	62(40-90)	71(55-90)	*P<0.001	0.428
Extension of the wrist (°)	55(35-65)	57(35-65)	0.020	44(20-70)	54(35-75)	*P<0.001	*0.002
Radial deviation of the wrist (°)	25(15-35)	27(15-30)	0.007	19(10-30)	23(15-40)	*P<0.001	*P<0.001
Ulnar deviation of the wrist(°)	30(20-40)	32(20-40)	0.024	30(15-40)	35(20-45)	*P<0.001	0.9
Pronation of forearm(°)	85(75-90)	86.5(75-90)	0.063	78(30-90)	82.6 (60-90)	*0.002	0.059
Supination of the forearm (°)	87(80-90)	88(80-90)	0.317	80(45-90)	86(80-90)	*0.002	*0.005
Grip strength (kg)	21(8-37)	25(15-37)	0.099	27(10-46)	30(14-50)	*0.005	0.57
DASH score	5(0-22)			13(0-72)			0.6

*kg: kilograms

When the unaffected and operated wrists of the patients in Group A were compared, it was seen that there was a statistically significant difference in favor of the unaffected wrist in terms of palmar flexion (p: 0.009), dorsiflexion (p: 0.02), and radial deviation (0.007) levels, but there was no difference in ulnar deviation (p: 0.24), pronation (p: 0.63), and supination (p: 0.32) levels. In addition, wrists with good grip strength were observed to be significantly better (p: 0.005).

Given the unaffected and operated patients in group B, there was seen a significant difference in the palmar flexion, dorsiflexion, ulnar deviation, radial deviation measurements (p<0.001), and the pronation and supination levels (p:0.002). However, a significant difference was not seen in the grip strength (p:0.1).

When the operated wrists of both patient groups were compared, there was seen no significant difference in the wrist palmar flexion (p:0.42), pronation (0.6), DASH score (p:0.6), and grip strength (p:0.6). In contrast, there was seen a significant difference in the dorsiflexion (p:0.002), radial deviation (p<0.001), and supination (p:0.005) levels for group A.

In Group A, grade 1-2 scapholunate ligament lesion was observed in the wrists of 5 patients according to simultaneous Geissler arthroscopic scapholunate ligament injury classification[14]. TFCC lesion was observed in the wrists of 8 patients. While these

patients were not subjected to a repair process for the scapholunate ligament injury, an arthroscopic repair process was performed for five patients with stage 1B TFCC lesions according to the classification. According to Palmer's type, only debridement was performed for three patients of stage 1A[15]. After DRUJ instability was detected in one patient in the postoperative 12th month, a repair process for TFCC was performed immediately.

Regarding complications, we applied a material removal process to 3 patients (postop six months, eight months, and 12 months) due to the irritation caused by the implants used in group A; a transient radial neuropraxia developed in 2 patients healed without any intervention. EPL tendon rupture was detected in the sixth postoperative month as the screw of the volar plate applied to one patient in group B was prolonged and caused irritation. Then it was repaired through a primary repair process. Again, a patient in group B was subjected to the material removal process and carpal tunnel surgery in the same session.

DISCUSSION

In our study, we compared the groups of patients treated with arthroscopy-assisted fragment-specific fixation method and volar plate osteosynthesis methods in terms of postoperative radiological results, joint range of motion, hand grip strength, and DASH clinical scores in patients with intra-articular distal radius fractures involving the middle column.

There was no statistically significant difference between the two groups regarding radiological results. In addition, both groups were found to be statistically similar in terms of the mean postoperative DASH scores and grip strength.

While it was observed that the operated side was significantly affected in terms of Flexion-Dorsiflexion, Ulnar-Radial deviation, and Pronation-Supination angles from wrist movements, the group that underwent arthroscopically assisted fragment-specific fixation was found to be significantly superior among the surgical groups in terms of dorsiflexion, radial deviation, and supination.

Recent studies have reported the inadequacy of this volar plate technique with locked plates to treat DER fractures when the fracture line is too distal, or the fragment is too small[16]. In particular, fractures involving the medial column can be challenging due to volar exposure and the inability to address concomitant intra-articular pathology. Burnier and Christiaens reported that arthroscopic support is superior to fluoroscopic assessment for direct intra-articular visualization[4,5].

Based on the view that arthroscopy-assisted placement and fixation of specific fracture fragments have a place in the order of fractures and their obsession with appropriate surgical materials[5], we investigated such fractures in this study.

On the other hand, radiographic measurement data and subjective satisfaction criteria are often sufficient to evaluate distal radius fractures. However, in addition to these methods, the sum of all these assessment parameters provides more valuable data for assessing fracture outcomes in this region, where available data and motion measurements, especially forearm rotation, are often affected[17]. Therefore, we used these assessment criteria in our study for these reasons.

The incidence of concomitant soft tissue injuries of the wrist associated with the DER fractures was reported to be a tear of the scapholunate ligament of 29.8%, a tear of the TFCC of 62.4%, and an intra-articular irregularity of 22.7%[11]. We obtained similar results in our patients who underwent arthroscopy. Arthroscopically assisted fracture osteosynthesis allows simultaneous surgical treatment of these hidden fractures, otherwise untreated by the conventional method, achieving good functional results. We can find some examples in the literature, especially about the effect of arthroscopically assisted wrist surgery on ligament pathologies[18,19].

In some of our patients, we found a significant difference in radial deviation, especially between the two groups, due to the fixations we used for radial column fracture in conjunction with medial column fracture. There was also a significant difference in pronation and supination of the wrist, especially with the anatomical restoration of DUC. Since the fragment-specific plate used for the fractures involving the dorsal corner and styloid is biomechanically more stable than volar plating[20], the advantage of fragment-specific plating in stabilization and proper healing of the fracture is undeniable.

We compared the operated and unaffected wrists of both groups. Group A significantly differed in flexion, extension, radial deviation, and ulnar deviation. In contrast, no significant difference was found in pronation supination and grip strength. In

group B, a significant difference was observed in favor of the unaffected side in all movements and grip strength, especially flexion, extension, ulnar deviation, and radial deviation. When the two groups were compared, there was a significant difference in extension, radial deviation, and supination in favor of group A, although there was a difference between the ROM values of the unaffected extremities of the patients.

On the other hand, a difference close to the significance level was observed in pronation. In addition, a distinction was observed in joint movements (which was more pronounced, especially in group B). Due to these results, we think that the stability of the fracture achieved by the suitability of the fragment-specific plates used for the fractures, especially in the region's anatomy in group A, contributed to the difference, particularly in extension and radial deviation. We attribute the low restriction in supination and pronation to removing intra-articular soft tissue and fracture fragments, mainly due to wrist arthroscopy and interventions on the possible pathologies of the TFCC and scapholunate ligament.

In a study by Bolmers et al., the patients with AO type B and type C fractures were compared in terms of osteoarthritis, joint motion, grip strength, DASH, MAYO, and Gartland scores, and a significant difference was found in terms of volar tilt in the lateral graph only[21]. However, Souer et al. reported that no significant difference was found in the long-term follow-up of patients with volar shear fractures of type AO B and C[22]. Therefore, we focused on the medial column in the study's design and included the patients with both AO type B and AO type C fractures, including the medial column.

Similar to our study, in comparing fragment-specific techniques with volar plating, no difference was found between the two groups regarding DASH score, joint range of motion (ROM), and grip strength[12]. Therefore, in our study, we could attribute the fact that fragment-specific technique seems to be better than volar plating for ROM to arthroscopically assisted therapy. Similarly, there is a consensus in the literature that arthroscopically assisted surgery positively affects the treatment of ligamentous injuries[18,19]. Furthermore, as we mentioned earlier, arthroscopically assisted surgery can contribute positively to these outcomes due to its positive effect on the intra-articular gap and step-off[4,5,8].

While transient neuropraxia of the radial nerve is the most common complication in fragment-specific technique, carpal tunnel syndrome, complex regional pain syndrome, pin loosening, EPL rupture, and implant irritation are other complications[12].In volar plating, the complications are carpal tunnel syndrome, complex regional pain syndrome, tendon rupture, and penetration of screws into joints[23]. Loss of reduction is another complication. Three patients underwent re-operation in our study in group A due to implant irritation. One patient underwent TFCC repair again due to wrist instability; transient radial neuropraxia was observed in 2 patients, which was resolved without any intervention. In group B, one patient experienced an EPL rupture due to the long screw length, which was repaired. Finally, one patient underwent surgery due to carpal tunnel syndrome, which developed later.

Limitations of our study are the fact that it was a retrospective study; it was not able to be proven to which one the obtained results were related due to both implant and arthroscopy differences between the two groups; the patients with both AO type B and type C fractures were not included in the study although there were studies which reported that there no difference in-between, the other weaknesses are the learning curve of wrist and a relatively small number of patients.

Consequently, we think that the arthroscopic intervention-assisted fragment-specific fracture fixation, which is applied as an alternative to the plate and screw fixation used by a volar approach in distal radius fractures extending to the joint, is more advantageous as it contributes to the wrist joint movements (especially forearm rotations), reveals the accompanying soft tissue damages and provides the possibility of intervention. In patients with intra-articular distal radius fractures, arthroscopic assisted fragment-specific fixation is technically a laborious procedure that may require a learning curve. However, it can be beneficial to improve postoperative results, especially in young patients with a high range of motion expectation.

Yazar Katkıları: Çalışma konsepti/Tasarımı: MÜÇ, AP, FF; Veri toplama: MÜÇ; Veri analizi ve yorumlama: FF; Yazı taslağı: AP; İçeriğin eleştirel incelenmesi: MÜÇ, FF; Son onay ve sorumluluk: MÜÇ, AP, FF; Teknik ve malzeme desteği: MÜÇ, AP; Süpervizyon: MÜÇ, AP, FF; Fon sağlama (mevcut ise): yok.
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REFERENCES

1. Helmerhorst GT, Kloen P. Orthogonal plating of intra-articular distal radius fractures with an associated radial column fracture via a single volar approach. Injury. 2012;43:1307-12.
2. Rikli D, Regazzoni P. Distale Radiusfrakturen [Distal radius fractures]. Schweiz Med Wochenschr. 1999;129:776-85.
3. Meinberg EG, Agel J, Roberts CS, Karam MD, Kellam JF. Fracture and dislocation classification compendium-2018. J Orthop Trauma. 2018;32:1-170.
4. Rozental TD, Blazar PE. Functional outcome and complications after volar plating for dorsally displaced, unstable distal radius fractures. J Hand Surg Am. 2006;31:359-65.
5. Rhee PC, Medoff RJ, Shin AY. Complex distal radius fractures: an anatomic algorithm for surgical management. J Am Acad Orthop Surg. 2017;25:77-88.
6. Burnier JS, Herzberg G, Izem Y. Traitement des fractures articulaires du radius distal sous arthroscopie: le but anatomique est-il atteint?. Chirurgie de la Main. 2013;6:432-7.
7. Christiaens N, Nedellec G, Guerre E, Guillou J, Demondion X, Fontaine C et al. Contribution of arthroscopy to the treatment of intraarticular fracture of the distal radius: Retrospective study of 40 cases. Hand Surg Rehabil. 2017;36:268-74.
8. Huish EG Jr, Coury JG, Ibrahim MA, Trzeciak MA. Radiographic outcomes of dorsal distraction distal radius plating for fractures with dorsal marginal impaction. Hand (N Y). 2018;13:346-9.
9. Knirk JL, Jupiter JB. Intra-articular fractures of the distal end of the radius in young adults. J Bone Joint Surg Am. 1986;68:647-59.
10. Saab M, Wunenburger PE, Guerre E, Chantelot C, Morel V, Ehlinger M et al. Does arthroscopic assistance improve reduction in distal articular radius fracture? A retrospective comparative study using a blind CT assessment. Eur J Orthop Surg Traumatol. 2019;29:405-11.
11. Abe Y. Plate presetting and arthroscopic reduction technique (PART) for treatment of distal radius fractures. Handchir Mikrochir Plast Chir. 2014;46:278-85.
12. Landgren M, Abramo A, Geijer M, Kopylov P, Tägil M. Fragment-specific fixation versus volar locking plates in primarily nonreducible or secondarily redisplaced distal radius fractures: a randomized controlled study. J Hand Surg Am. 2017;42:156-65.
13. Sammer DM, Fuller DS, Kim HM, Chung KC. A comparative study of fragment-specific versus volar plate fixation of distal radius fractures. Plast Reconstr Surg. 2008;122:1441-50.
14. Kleinlugtenbelt YV, Krol RG, Bhandari M, Goslings JC, Poolman RW, Scholtes VAB. Are the patient-rated wrist evaluation (PRWE) and the disabilities of the arm, shoulder and hand (DASH) questionnaire used in distal radial fractures truly valid and reliable? Bone Joint Res. 2018;7:36-45.
15. Cornu A, Amouyel T, Chantelot C, Saab M. Clinical, functional and prognostic results after repair of peripheral lesions of the triangular fibrocartilage complex: a retrospective study of 21 patients. Eur J Orthop Surg Traumatol. 2021;31:557-62.
16. Orbay JL, Rubio F, Vernon LL. Prevent collapse and salvage failures of the volar rim of the distal radius. J Wrist Surg. 2016;5:17-21.
17. Herzberg G, Burnier M, Nakamura T. A new wrist clinical evaluation score. J Wrist Surg. 2018;7:109-14.
18. Forward DP, Lindau TR, Melsom DS. Intercarpal ligament injuries associated with fractures of the distal part of the radius. J Bone Joint Surg Am. 2007;89:2334-40.
19. Hohendorff B, Eck M, Mühldorfer M, Fodor S, Schmitt R, Prommersberger KJ. [Palmar wrist arthroscopy for evaluation of concomitant carpal lesions in operative treatment of distal intraarticular radius fractures]. Handchir Mikrochir Plast Chir. 2009;41:295-9.
20. Martin DP, Park AG, Jamison D 4th, Jones CM, Ilyas AM. Biomechanical comparison of titanium locking fragment-specific and volar locking plates for AO B1 and B2 fractures of the distal radius. J Hand Surg Am. 2019;44:1093.e1-8.
21. Bolmers A, Luiten WE, Doornberg JN, Brouwer KM, Goslings JC, Ring D et al. A comparison of the long-term outcome of partial articular (AO Type B) and complete articular (AO Type C) distal radius fractures. J Hand Surg Am. 2013;38:753-9.
22. Souer JS, Ring D, Jupiter JB, Matschke S, Audige L, Marent-Huber M; AOCID Prospective ORIF Distal Radius Study Group. Comparison of AO Type-B and Type-C volar shearing fractures of the distal part of the radius. J Bone Joint Surg Am. 2009;91:2605-11.
23. Thorninger R, Madsen ML, Wæver D, Borris LC, Rölfing JHD. Complications of volar locking plating of distal radius fractures in 576 patients with 3.2 years follow-up. Injury. 2017;48:1104-9.

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