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Retrospective Analysis of Treatment Selection, Radiological Outcomes, and Complications in Distal Radius Fractures across Age Groups

Yaş Gruplarına Göre Distal Radius Kırıklarında Tedavi Seçimi, Radyolojik Sonuçlar ve Komplikasyonların Retrospektif Analizi

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ABSTRACT

Aim: To evaluate the effect of age on treatment selection, radiological outcomes, and complications in distal radius fractures.
Materials and Methods:A total of 97 patients aged ≥18 years with distal radius fractures treated between January and December 2020 were retrospectively reviewed and categorized into three age groups of 18–44, 45–64, and ≥65 years. Conservative (splint/cast with or without closed reduction) and surgical (mostly, volar locking plate-screw) treatments were applied. Volar tilt, volar angulation, radial length, radial inclination, intra-articular step-off, and gap were measured at three time points.
Results: Age groups were found to be significantly associated with treatment modality and the presence of complications ($p<0.05$). The main effect of time on volar tilt and volar angulation was significant (both $p<0.05$), whereas the age group × time interaction was not significant. A significant age group × time interaction was observed for radial length ($p=0.040$). In the ≥65 years group, a negative correlation was identified between the degree of volar tilt correction and changes during follow-up ($r=-0.55$; $p=0.018$). No statistically significant differences in QuickDASH scores were observed among the age groups ($p > 0.05$).
Conclusion: Age was seen to influence treatment preferences, complication rates, and particularly the maintenance of radial length in distal radius fractures. Geriatric patients exhibit a more pronounced risk of reduction loss, and functional outcomes did not differ significantly between age groups, despite less favorable radiological maintenance in geriatric patients.

Keywords: distal radius fracture, age, complication

ÖZ

Amaç: Bu çalışmanın amacı, distal radius kırıklarında yaşın tedavi seçimi, radyolojik sonuçlar ve komplikasyonlar üzerindeki etkisini değerlendirmektir.
Gereç ve Yöntemler: Ocak–Aralık 2020 tarihleri arasında distal radius kırığı nedeniyle tedavi edilen ≥18 yaşındaki toplam 97 hasta retrospektif olarak incelendi ve 18–44, 45–64 ve ≥65 yaş olmak üzere üç gruba ayrıldı. Konservatif (atel/alçı ile veya kapalı redüksiyonlu) ve cerrahi (çoğunlukla volar kilitli plak-vida) tedavi yöntemleri uygulandı. Volar tilt, volar angulasyon, radial uzunluk, radial inklinasyon, intraartiküler step-off ve gap ölçümleri üç farklı zaman noktasında değerlendirildi.
Bulgular: Yaş grupları ile tedavi yöntemi seçimi ve komplikasyon varlığı arasında istatistiksel olarak anlamlı ilişki saptandı ($p<0,05$). Volar tilt ve volar angulasyon açısından zamanın ana etkisi anlamlı bulunurken (her ikisi, $p<0,05$), yaş grubu × zaman etkileşimi anlamlı değildi. Radial uzunluk için ise yaş grubu × zaman etkileşimi anlamlı bulundu ($p=0,040$). ≥65 yaş grubunda, volar tilt düzelme miktarı ile takip süresince meydana gelen değişiklikler arasında negatif yönde anlamlı bir korelasyon saptandı ($r=-0,55$; $p=0,018$). Yaş grupları arasında QuickDASH skorları açısından istatistiksel olarak anlamlı fark izlenmedi ($p > 0,05$).
Sonuç: Yaşın, distal radius kırıklarında tedavi tercihleri, komplikasyon oranları ve özellikle radial uzunluğun korunması üzerinde etkili olduğu görülmüştür. Geriatrik hastalarda redüksiyon kaybı riski daha belirgindir ve radyolojik sonuçlar daha olumsuz olmasına rağmen fonksiyonel sonuçlar yaş grupları arasında anlamlı farklılık göstermemektedir.

Anahtar Kelimeler: distal radius kırığı, yaş, komplikasyon

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Introduction

The incidence of distal radius fractures has increased across all age groups in recent years. The distribution of distal radius fractures in the general adult population shows a bimodal distribution, with an increased incidence in young men and postmenopausal women[1,2,3]. Increased life expectancy and the growing prevalence of osteoporosis have contributed to the rising incidence of distal radius fractures in the geriatric population [4,5].

For patients presenting at the emergency department or orthopedics and traumatology outpatient clinics with distal radius fractures, one of the primary treatment strategies is splint or cast immobilization [6]. Fractures without loss of reduction may be managed directly with splint or cast application, whereas fractures with loss of reduction may require closed reduction manoeuvres followed by splint or cast immobilization [7]. Surgical treatment may be preferred in cases of displaced intra-articular fractures, instability, or open fractures. Surgical options include fixation with Kirschner wires, volar locking plates of the distal radius, external fixators, or combinations of these methods [8]. Both non-operative and operative treatments are associated with various complications, among which loss of reduction is one of the most common. Inadequately treated fractures may lead to these complications, representing an important cause of morbidity [9]. Furthermore, surgical treatment is more costly than non-operative management, and the management of surgery-related complications further increases overall treatment costs [10].

A clinically significant issue is whether age affects treatment choice, follow-up outcomes, and complication rates in distal radius fractures. Although distal radius fractures commonly affect individuals of all ages, most previous studies have focused on specific age groups, and the number of studies evaluating the effectiveness of treatment modalities according to age groups remains limited [5].

Therefore, the aim of this study was to evaluate the effect of patient age on treatment preferences, radiological outcomes, functional outcomes, and the development of complications in distal radius fractures.

MATERIALS AND METHODS

This study was designed as a single-centre, retrospective observational study without a control group. This study was conducted through the retrospective evaluation of patients diagnosed with distal radius fractures who presented at the Emergency Department or the Orthopedics and Traumatology Outpatient Clinic of a tertiary-level healthcare centre between January 2020 and December 2020. This study was approved by the Alanya Alaaddin Keykubat University Faculty of Medicine Clinical Research Ethics Committee (Decision No: 26-19, Date: 11/12/2024). The study was conducted in accordance with the principles of the Declaration of Helsinki and employed a retrospective study design.

Inclusion criteria: Patients aged ≥18 years were included. Patients with follow-up not completed at our institution, those with radiographs inadequate for measurement, and patients younger than 18 years were excluded. Only patients with a minimum follow-up duration of 12 months were included in the study.

Age Groups: In accordance with previous studies evaluating age-related radiological and clinical outcomes in distal radius fractures, the patients were separated into three age groups as 18–44, 45–64, and ≥65 years [5]. Demographic data, fracture side, treatment modality (conservative or surgical), and complications were recorded from patient files and the hospital information management system. Radiological evaluations were performed at the same three predefined time points (at presentation, post-treatment, and at final follow-up) across all age groups. Thus, the study design ensured comparable follow-up durations for all the age groups. A total of 97 patients met the inclusion criteria. Of these, 96 patients had complete radiographs available at all three predefined time points (baseline, post-treatment, and final follow-up) and were therefore included in the repeated-measures analysis using linear mixed models.

Fracture Classification: All distal radius fractures were classified according to AO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen/

Orthopaedic Trauma Association) classification systems using radiographs obtained at presentation and, when available, computed tomography images[3].

Treatment Modalities: Patients were categorized into two groups according to the treatment modality: conservative and surgical treatment. Conservative treatment consisted of direct splint or cast immobilization for stable fractures not requiring reduction, and splint or cast immobilization following closed reduction for fractures requiring reduction. Surgical treatment was performed in cases of unstable fractures, intra-articular displacement, inability to maintain reduction. Surgical treatment mainly consisted of osteosynthesis using a volar locking plate-screw system. Case examples from our patients, one for each treatment modalities, are presented in Figures 1 and 2 (Figure 1,Figure 2).

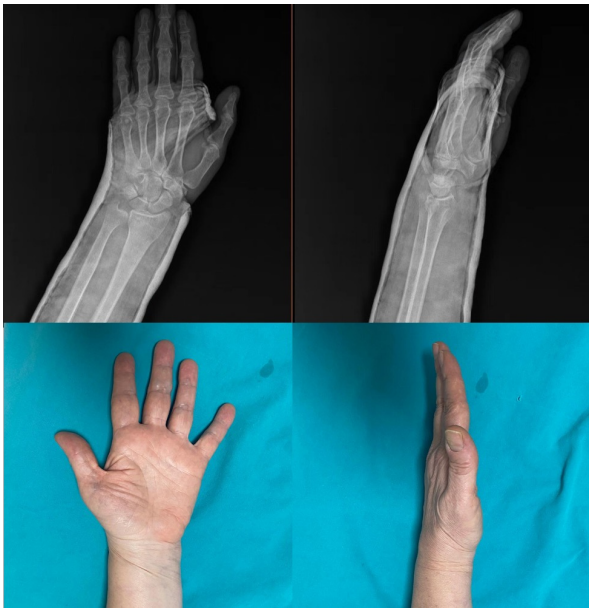

Figure 1: Radiological and clinical images of a patient treated conservatively.

Radiological Evaluation: All radiological measurements were performed by a single Orthopedics and Traumatology specialist. The radiological parameters evaluated included volar tilt, volar angulation, radial length, radial inclination, intra-articular step-off, and intra-articular gap. Volar tilt and volar angulation were evaluated as distinct radiological parameters in this study. Volar tilt was defined as the angle between the distal radial articular surface and the longitudinal axis of the radius on the lateral radiograph, reflecting the anatomic orientation of the joint surface. Volar angulation represented the angular relationship between fracture fragments in the sagittal plane and indicated the degree of reduction. These two parameters were therefore treated as conceptually and methodologically separate variables in the analyses [11].

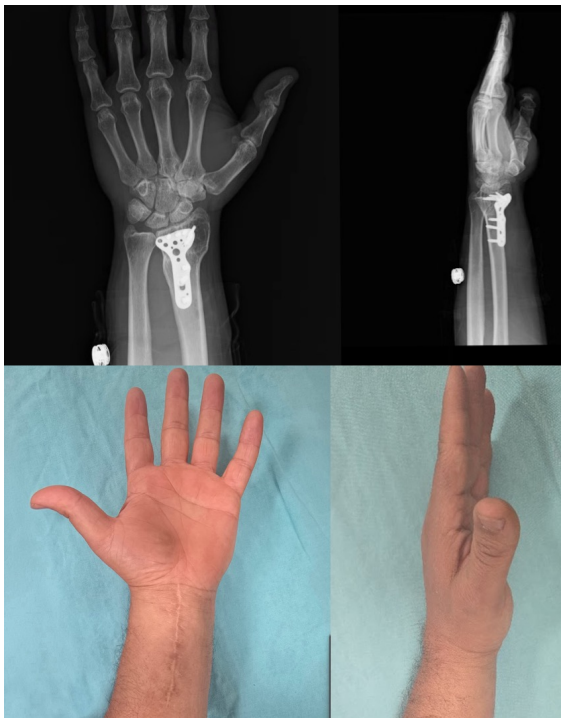

Figure 2: Radiological and clinical images of a surgically treated patient.

Measurements were obtained at three time points: at presentation, post-treatment follow-up, and final follow-up. The initial radiograph was obtained on first presentation at the emergency department or outpatient clinic before any intervention. The post-treatment radiograph was obtained after surgical or conservative intervention. The final follow-up radiograph was obtained when treatment was completed and no further radiological progression was expected. All the measurements were performed using standard measurement tools on digital radiography systems.

Clinical Evaluation: In our study, functional assessment was performed using the QuickDASH-TR (Turkish version of the Disabilities of the Arm, Shoulder and Hand questionnaire). The DASH questionnaire has been shown to be a valid and reliable instrument for use in patients with various upper extremity disorders. Its cultural adaptation,

validity, and reliability for the Turkish population have been previously established. The DASH questionnaire has also been widely used in similar studies. In addition, a shorter version of the DASH consisting of 11 items, known as the QuickDASH, which also has a validated Turkish adaptation, is available [12-14]. Interviews were conducted following a predefined standardized protocol to minimize measurement error and observer-related bias. Patients were contacted by telephone during the follow-up period. The QuickDASH questionnaire was administered using a structured interview format by two Orthopedics and Traumatology residents, with questions asked verbally and responses recorded accordingly. Of the 97 patients, 64 were successfully contacted.

Statistical Analysis: All statistical analyses were performed using jamovi software (version 2.7.6; The jamovi Project, Sydney, Australia).The normality of distribution of numerical variables was assessed using the Shapiro–Wilk test. Variables with normal distribution were presented as mean ± standard deviation values, and non-normally distributed variables as median (interquartile range) values. Categorical variables were expressed as number and percentage [n (%)].

Comparisons between two independent groups were performed using the Student's t-test. Comparisons among more than two groups were performed using the Kruskal–Wallis test. Associations between categorical variables were analyzed using the chi-square (χ^2) test, and when appropriate, Pearson χ^2, Fisher's exact test, or the likelihood ratio χ^2 test was applied.

Linear mixed models (LMM) were used to evaluate the effects of age group and time within the same model, taking into account the repeated-measures structure and distributional characteristics of the data. When a significant time × age group interaction was detected, Bonferroni-adjusted pairwise p values were reported.

A value of $p < 0.05$ was considered statistically significant in all analyses.

RESULTS

The demographic and clinical characteristics of the included patients, together with the applied treatment modalities and the distribution of complications, were summarized (Table 1).

Age distribution according to sex and comparisons of demographic and clinical characteristics across age groups were analyzed, and these results are presented in Tables 2 and 3. In addition, the distribution of distal radius fractures according to the AO/OTA classification systems was evaluated (Tables 1,2,3 and 4).

Table 1. Demographic characteristics of the patients

Variable	n	%
Age Group		
18–44 years	25	25.8
45–64 years	48	49.5
≥65 years	24	24.7
Sex		
Male	46	47.4
Female	51	52.6
Side		
Right	42	43.3
Left	55	56.7
Treatment Type		
Conservative Treatment	65	67.7
Surgical Treatment	31	32.3
Complication		
None	78	80.4
Yes	19	19.6

Table 2. Age distribution according to sex

	Total (n=97)	Male (n=46)	Female (n=51)	p value
Age (years) Mean ± S.D.	54.0 ±17.2	49.1 ± 17.8	58.3 ± 15.5	0.008

A statistically significant association was found between age groups and sex, treatment modality, treatment type, and the presence of complications ($p<0.05$). The proportion of males in the 18–44 years age group (68.0%) was significantly higher than that in the ≥65 years age group (25%). Conversely, the proportion of females in the 18–44 years age group (32.0%) was significantly lower than that in the ≥65 years age group (75%) (Table 5).

In patients without complications, the proportion of individuals in the 18–44 years age group was higher than in the 45–64 and ≥65 years age groups. Of the patients with complications, there was seen to be a lower proportion of those aged

Table 3. Distribution of clinical characteristics according to age groups

	Age Groups						p
	18-44 yaş		45-64 yaş		≥65 yaş		
Gender	N	%	N	%	N	%	
Male	17	68.0	23	47.9	6	25.0	0.011
Female	8	32.0	25	52.1	18	75.0	
Side							
Right	13	52.0	21	43.8	8	33.3	0.418
Left	12	48.0	27	56.3	16	66.7	
Treatment type							
Conservative Treatment	13	52.0	31	66.0	21	87.5	0,028
Surgical Treatment	12	48.0	16	34.0	3	12.5	
Complications							
None	24	96.0	37	77.1	17	70.8	0.032
Yes	1	4.0	11	22.9	7	29.2	

Table 4. Distribution of fracture classifications according to age groups

	Age Groups					
	18-44		45-64		≥65	
AO Classification						
2R3A1	2	8.0	3	6.4	2	8.3
2R3A2	11	44.0	24	51.1	17	70.8
2R3A3	0	0.0	1	2.1	0	0.0
2R3B1	2	8.0	1	2.1	0	0.0
2R3B2	1	4.0	0	0.0	1	4.2
2R3B3	1	4.0	1	2.1	0	0.0
2R3C1	2	8.0	5	10.6	0	0.0
2R3C2	6	24.0	11	23.4	4	16.7
2R3C3	0	0.0	1	2.1	0	0.0

Table 5. Distribution of complications according to age groups

	Age Groups			
Complication	18-44	45-64	≥65	Total
None	24 (96,0)	37 (77,1)	17 (70,8)	78 (80,4)
Complex regional pain syndrome (CRPS)	0 (0,0)	0 (0,0)	1 (4,2)	1 (1,0)
Malunion	0 (0,0)	2 (4,2)	0 (0,0)	2 (2,1)
Radial shortening	0 (0,0)	4 (8,3)	4 (16,7)	8 (8,2)
Ulnar malunion	0 (0,0)	1 (2,1)	0 (0,0)	1 (1,0)
Radial shortening with concomitant scapholunate ligament injury	0 (0,0)	1 (2,1)	0 (0,0)	1 (1,0)
Implant failure	1 (4,0)	0 (0,0)	0 (0,0)	1 (1,0)
Radial shift	0 (0,0)	0 (0,0)	1 (4,2)	1 (1,0)
Dorsal angulation	0 (0,0)	2 (4,2)	1 (4,2)	3 (3,1)
Loss of reduction with inadequate follow-up	0 (0,0)	1 (2,1)	0 (0,0)	1 (1,0)
Total	25 100)	48(100)	24(100)	97(100)

Data are presented as n (%).

Table 6: Comparisons between measurements by age group.

	Age Groups									
	18-44			45-64			≥65			
	Measurements			Measurements			Measurements			
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	p
Volar Tilt	-4.30 (31.08)	4.15 (8.60)	4.10 (6.50)	-10.70 (29.55)	1.00 (11.83)	-1.2(16.48)	-11.90(30.10)	-1.10(16.75)	-1.95(13.13)	0.386
Volar Angulation	25.9 (15.40)	26.1 (10.25)	24.3 (8.98)	19.8 (23.25)	26.0 (13.85)	25.6(9.82)	24.4(31.55)	22.3(18.60)	21.7(16.15)	0.975
Radial Length	3.10 (8.97)	3.80 (7.20)	2.65 (5.33)	8.45 (6.63)	6.60 (6.40)	6.85(5.35)	7.80(9.60)	6.40(5.00)	3.50(5.97)	0.040
Radial Inclination	12.2± 7.54	14.8± 9.87	15.1± 8.86	19.9± 5.14	19.6± 6.58	18.6±7.85	20.3±6.79	19.6±6.81	18.0±5.11	0.427
Step-off	0.0 (0.0)	0.0 (0.0)	0.0(0.0)	0.0 (0.0)	0.0 (0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	--
Gap	0.0 (1.80)	0.0 (0.0)	0 (0.8)	0.0 (0.0)	0.0 (0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	--

1st measurement: at presentation; 2nd measurement: post-treatment follow-up; 3rd measurement: final follow-up. P values were calculated for the age group × measurement time interaction using linear mixed model (LMM) analysis. Radial inclination is presented as mean ± standard deviation, whereas the other parameters are summarized as median (interquartile range). p-values were calculated for the age group × measurement time interaction in the LMM analysis. Radial inclination is summarized as mean ± standard deviation, while others are summarized as median (IQR) values.

18–44 years than of those aged 45–64 years and ≥65 years (Table 5).

The distribution of fractures according to the AO/OTA classification systems across age groups was analyzed (Table 4). The distribution of complications by age group was evaluated (Table 5). As the majority of observed values in Table 6 were "0," chi-square testing could not be performed for statistical comparison; therefore, no p values were reported, and the table was prepared for descriptive purposes only. Similarly, because most observed values in Table 7 were "0," chi-square testing was not applicable, and the table was descriptive in nature without p values.

Changes in radiological measurements over time according to age groups were analyzed (Table 6). The main effects of different measurement time points on radiological parameters were evaluated (Table 7).

For volar tilt measurements, no significant interaction was found between measurement time and age group ($F(4,72.05)=1.05$, $p=0.386$). Measurement time was determined to have a significant main effect on volar tilt ($F(2,72.47)=18.30$, $p<0.001$), indicating a statistically significant change in volar tilt values over time. The volar tilt levels were determined to differ significantly among the age groups ($F(2,74.73)=3.73$, $p=0.028$) (Table 6).

The second measurements of volar tilt were observed to be significantly higher than the first measurements ($p<0.001$), and values at the third measurement time point were also significantly higher compared with the first measurements ($p<0.001$). No significant difference was observed between the second and third measurements ($p=0.097$) (Table 7).

Table 7: Main effects of different measurement time.

	Measurements			p
	1st	2nd	3rd	
Volar Tilt	-10.70 (28.7)	1.60 (11.9)	1.35 (14.2)	0.001
Volar angulation	24.1 (28.8)	25.9 (13.5)	24.6 (11.0)	0.003
Radial Length	2.90 (7.00)	6.90 (5.95)	5.90 (5.95)	<0.001
Radial Inclination	19.4±6.43	19.5±6.48	14.2±9.05	<0.001
Step-off	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	--
Gap	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	---

Data are summarized as mean ± standard deviation and median (IQR).

The 18–44 years age group demonstrated significantly higher volar tilt values compared with the 45–64 years age group ($p=0.044$). No significant differences were observed in other age group comparisons (Table 6).

For volar angulation, no significant interaction was found between measurement time and age group ($F(4,72.31)=0.12$, $p=0.975$). The main effect of age group on volar angulation was not significant ($F(2,74.42)=1.55$, $p=0.219$). In contrast, measurement time had a significant main effect on volar angulation ($F(2,72.64)=6.44$, $p=0.003$).

The second measurement volar angulation values were significantly higher compared with the first measurement (p=0.002), and significantly higher at the third measurement compared with the first (p=0.024). No significant difference was found between the second and third measurements (p=0.816). (Table 6)

For radial length, a significant interaction between time and age group was detected (F(4,73.18)=2.65, p=0.040). In simple effects analyses, the 18–44 years age group showed significantly higher values at the second and third measurements compared with the first measurement (Bonferroni-adjusted p=0.003 and p=0.002, respectively). Similarly, in the 45–64 years age group, the second and third measurements were significantly higher than the first measurement (p=0.004 and p=0.012, respectively). In the ≥65 years age group, a significant increase was observed only from the first to the second measurement (p=0.024), and the other comparisons were not significant (Figure 3)(Table 6).

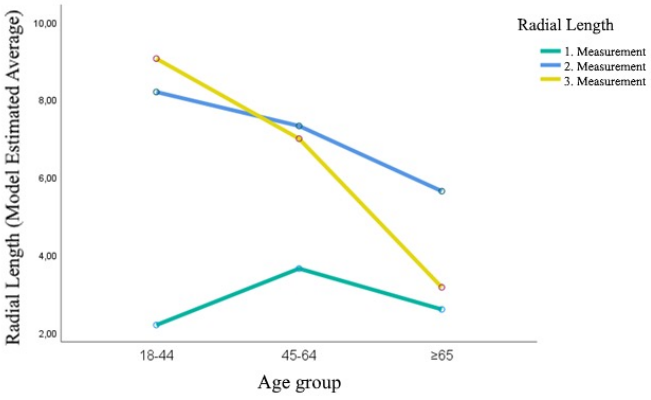

Figure 3: Changes in radial length across age groups and over time based on estimated marginal means obtained from the linear mixed model.

For radial inclination, measurement time had a significant main effect (F(1.51,104.33)=18.88, p<0.001). The second and third measurement values were significantly higher than those at the first measurement (both p<0.001). No significant difference was observed between the second and third measurements (p=1.000). The interaction between measurement time and age group was not significant (F(3.02,104.33)=0.97, p=0.411) (Table 7).

The change between volar tilt measured at presentation and after treatment (volar tilt1–2) reflected the amount of reduction achieved with treatment, whereas the change between post-treatment and final follow-up measurements (volar tilt2–3) represented loss of reduction during the follow-up period.

In the whole patient cohort, no statistically significant correlation was found between volar tilt1–2 change and volar tilt2–3 change (r=–0.19, p=0.082).

In the subgroup analyses by age, no significant association was observed between volar tilt1–2 and volar tilt2–3 in the 18–44 and 45–64 years age groups (p>0.05). In the ≥65 years age group, a moderate, negative, and statistically significant correlation was identified between the amount of volar tilt correction achieved during treatment and the change in volar tilt during follow-up (r=–0.55, p=0.018). This finding indicates that in older patients, greater initial correction was associated with a higher degree of reduction loss during follow-up.

No statistically significant differences in QuickDASH scores were observed among the age groups (χ^2 = 1.82, df = 2, p > 0.05). Accordingly, the observed variations in scores did not reach statistical significance and are likely attributable to sample size limitations and the wide dispersion of the scores, rather than reflecting true differences between age groups.(Table 8) (Figure 4)

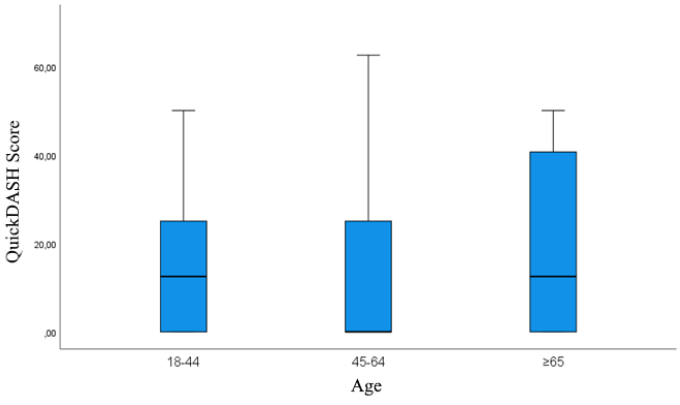

Figure 4: QuickDASH Score distributions by age group

Table 8 QuickDASH Score

Age Group	Quickdash	p
18-44 (n=13)	12.50 (28.13)	0.401
45-64 (n=40)	0.00 (25.0)	
≥65 (n=11)	12.50 (43.75)	

Data are summarized as median (IQR).

DISCUSSION

The main outcome of this study was that age significantly influences treatment preferences, radiological outcomes and the development of complications in distal radius fractures. In particular, the higher rate of conservative treatment and the increased frequency of complications observed in the older population support the decisive role of age-related biomechanical and biological factors in clinical outcomes.

The significantly higher proportion of female patients in the ≥65 years age group was seen to be consistent with the literature reporting that distal radius fractures in the geriatric population often occur on an osteoporotic background following low-energy trauma [1]. In contrast, the predominance of male patients in the 18–44 years age group can be explained by the higher incidence of high-energy trauma in young male populations. This demographic distribution is important for understanding age-specific fracture patterns and treatment strategies [15].

With respect to treatment preferences, conservative management was applied significantly more frequently in the older age group. This can be attributed to the likely presence of comorbidities, increased surgical risk, relatively lower functional expectations, and greater emphasis on patient compliance. Conversely, the higher rate of surgical treatment in younger patients may be related to the greater importance of maintaining anatomic reduction for optimal functional outcomes. Recent literature generally favours conservative treatment in elderly patients, suggesting that even when anatomic reduction goals are not fully achieved, functional outcomes may remain acceptable in the geriatric population [16,17].

The increase in complication rates with advancing age represents another important finding of this study. The higher incidence of complications such as radial shortening and dorsal angulation in the ≥65 years age group indicates that osteoporotic bone makes the maintenance of reduction more challenging. These findings suggest that age should be considered an independent risk factor for radiological loss of reduction in distal radius fractures [17].

When changes in radial length were evaluated across age groups during the follow-up period, older patients demonstrated a more pronounced tendency toward loss of reduction. In particular, the inability to preserve radial length at the final follow-up in the ≥65 years age group suggests that maintaining reduction is more challenging in geriatric patients. This finding may have clinically relevant implications for functional outcomes and is consistent with observations reported in previous studies [5]

Although a significant main effect of time was observed for radial inclination measurements, the absence of significant differences between the age groups suggests that this parameter may be more sensitive to the applied treatment modality than to age itself. The near-zero values of step-off and gap measurements across all the age groups indicate that intra-articular congruity was largely achieved. However, larger-scale studies are needed to better evaluate the relationship between these parameters and functional outcomes.

In the present study, no significant association was found between the amount of volar tilt correction achieved during treatment and subsequent loss of reduction in the whole patient cohort. However, in the ≥65 years age group, a significant negative correlation was observed between initial volar tilt correction and loss of reduction during the follow-up period. This finding suggests that greater initial correction of volar tilt in elderly patients may be associated with increased difficulty in maintaining reduction over time. These findings are consistent with those of previously published studies [18,19].

Functional outcomes following distal radius fractures were assessed using the QuickDASH score, and no significant differences were observed between the age groups. This finding may be interpreted as supportive evidence for the effectiveness of conservative treatment in elderly patients. Nevertheless, recent literature has suggested that QuickDASH scores may increase with age [20,21]. The absence of such an association in this study may be attributed to the relatively small sample size, underscoring the need for larger and more comprehensive case series.

Several limitations of this study should be

acknowledged. All radiological measurements were performed by a single observer. The retrospective design and relatively small sample size represent additional limitations. Osteoporosis status was not evaluated. Moreover, due to the low number of patients in certain complication subgroups, some comparisons were limited to descriptive analyses. Although no separate statistical comparison of follow-up duration among age groups was performed, the completion of the same minimum follow-up period by all patients and the use of standardized measurement time points most likely minimized the impact of this variable on the results. Importantly, the use of linear mixed models to analyze repeated measurements across the age groups constitutes a major strength of this study and enhances its statistical robustness.

Conclusion

The results of this study demonstrate that patient age significantly influences treatment preferences, the maintenance of radiological reduction, the development of complications, in distal radius fractures. In the older age group, higher rates of conservative treatment and increased frequency of complications were observed, with particular difficulty in maintaining radial length. However, radiological outcomes may not always correlate with clinical outcomes.

The finding that greater initial volar tilt correction in geriatric patients is associated with increased loss of reduction during the follow-up period suggests that aggressive anatomic correction goals should be carefully considered in this patient population.

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