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ORIGINAL ARTICLE

Comparison of AO, Schatzker, and three-column classification systems in tibial plateau fractures: Impact on functional outcomes

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ABSTRACT

Objectives: This study aimed to compare the AO, Schatzker, and Three-Column classification systems for tibial plateau fractures, focusing on their prognostic and functional outcome prediction and influence on clinical decisions across different trauma types.

Patients and methods: In this retrospective study, we examined 49 patients (36 males, 11 females; mean age: 40.6±11.8 years; range, 19 to 67 years) with tibial plateau fractures between January 2011 and January 2017. The fractures were classified using the AO, Schatzker, and three-column systems. The main outcome measurements included functional scores (Knee Injury and Osteoarthritis Outcome Score [KOOS], Hospital for Special Surgery [HSS]), range of motion (ROM), duration of hospitalization, thigh atrophy, operation time, and the development of osteoarthritis. The impact of smoking was also assessed.

Results: According to the AO classification, type B fractures obtained higher KOOS and HSS scores compared to type C fractures (p=0.013 and p=0.007, respectively). According to the Schatzker classification low-energy fractures achieved higher KOOS and HSS scores than high-energy fractures (p=0.013 and p=0.026, respectively). One-column fractures had higher KOOS and HSS scores compared to two-column and three-column fractures (p=0.007 and p=0.001, respectively). Two-column fractures had a lower ROM compared to other column fractures (p=0.022). Shorter hospital stays were recorded for Schatzker low-energy fractures (p=0.016), whereas higher thigh atrophy was found in Schatzker high-energy fractures (p=0.022) and AO type C fractures (p=0.018). Longer operation times were observed in AO type C fractures (p=0.037) and Schatzker high-energy fractures (p=0.017). According to the Kellgren–Lawrence classification, AO type C fractures and three-column fractures yielded worse outcomes (p=0.039 and p=0.001, respectively). Smoking had a negative impact on functional KOOS and HSS scores across all groups (p=0.022 and p=0.001, respectively).

Conclusion: This study highlights the predictive value of the AO, Schatzker, and Three-Column classification systems in determining functional outcomes and clinical data in tibial plateau fractures. Each system provides unique insights into different outcomes, suggesting their concurrent application may yield a more comprehensive prognosis.

Keywords: Classification, health care, outcome assessment, tibial plateau fractures.

Tibial plateau fractures are a relatively uncommon type of fracture, comprising only 1 to 2% of all fractures, but they account for a significant proportion (8%) of fractures in the elderly.[1] These fractures can occur due to either high-energy traumas in young patients or low-energy traumas in the elderly.[2,3] The structure of the tibial plateau region is such that there is limited soft tissue coverage, which can make it challenging to determine the most appropriate treatment option for high-energy traumas.[4-6]

Despite the existence of several classification systems, there is currently no consensus on which is the most effective. The choice of classification partially depends on surgeon preference and familiarity. A detailed comparative analysis of these systems could shed light on which system provides more beneficial information and guidance in clinical practice.

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In this study, the three classification systems that are most commonly used and have high intra- and interrater reliability were selected.[7,8] Hence, this study sought to compare the Arbeitsgemeinschaft für Osteosynthesefragen (AO), Schatzker, and three-column fracture classification systems to determine which is the most reliable and useful in determining prognosis and functional outcomes.

PATIENTS AND METHODS

In this retrospective study, patients who were hospitalized and treated for tibial plateau fractures at the Trakya University Faculty of Medicine, Department of Orthopedics and Traumatology between January 2011 and January 2017 were included. The inclusion criteria were being 18 years of age or older, being hospitalized for a tibia plateau fracture, and having a minimum of one-year follow-up. Exclusion criteria were pathological fractures, periprosthetic fractures, previous knee injuries, and mortality or amputation. During the study period, a total of 53 patients were admitted to our hospital with tibial plateau fractures. Throughout the follow-up period, one patient underwent an amputation procedure, one patient passed away, and two patients could not be reached for follow-up, leading to their exclusion from the study. Consequently, 49 knees of 49 patients (36 males, 11 females; mean age: 40.6±11.8 years; range, 19 to 67 years) were included in the final analysis.

Radiographs, computed tomography scans, and patient files were reviewed retrospectively, and fractures were classified according to the Schatzker, AO, and three-column classifications. Treatment methods included conservative (cast), open reduction internal fixation, minimal open reduction external fixation, and close reduction external fixation, following current fracture fixation principles. Final radiographs of patients were classified according to the Kellgren-Lawrence Classification for posttraumatic osteoarthritis. To determine prognosis, we evaluated patients' quality of life and functional status using the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Hospital for Special Surgery (HSS) Knee Society Score.[9] Furthermore, the range of motion (ROM) in patients with different types of fractures was investigated.

Statistical analysis

Data were analyzed using SPSS version 15.0 software (SPSS Inc., Chicago, IL, USA). A combination of parametric and nonparametric tests was used to analyze the data. The association between categorical variables was assessed using the chi-square test. For continuous variables, Student's t-test was employed in cases of normal distribution, while the Mann-Whitney U test was applied in nonparametric situations. Additionally, the Kruskal-Wallis test was used to compare multiple independent groups. The relationship between continuous variables was explored through Spearman correlation analysis, considering the nonnormal distribution of the data. A *p*-value of <0.05 was considered statistically significant.

RESULTS

The mean duration of follow-up for these patients was 42±2.8 (range, 13 to 90) months. Sixty-one percent of the fractures were caused by traffic-related accidents, with motorcycle accidents (32%), pedestrian-vehicle accidents (16.3%), and car accidents (14.2%) being the most common mechanisms. The fractures were classified using the AO, Schatzker, and three-column systems. Table I presents the demographic information and mechanism of injury.

In the AO classification system, type B fractures exhibited significantly higher median KOOS scores (92; interquartile range [IQR]: 9.3) compared to type C fractures (82.5; IQR: 22.9), with z= –2.47 and p=0.013. Similarly, type B fractures demonstrated significantly higher median HSS scores (96; IQR: 4) compared to type C fractures (90; IQR: 1), with z= –2.70 and p=0.007.

In the Schatzker classification system, patients with type 1, 2, and 3 (low-energy) fractures exhibited significantly higher median KOOS scores (92; IQR: 10.8) compared to patients with type 4, 5, and 6 (high-energy) fractures (83; IQR: 19.8), with z= –2.22 and p=0.026. Additionally, patients with type 1, 2, and 3 fractures also displayed significantly higher median HSS scores (96; IQR: 5.5) than those with type 4, 5, and 6 fractures (90; IQR: 11), with z= –2.50 and p=0.012.

Patients with one-column fractures demonstrated significantly higher functional outcomes, median KOOS scores (92.5; IQR: 12.1), and median HSS scores (96; IQR: 4.3) compared to those with two-column fractures, who had a median KOOS of 83 (IQR: 47.1) and median HSS score of 89 (IQR: 32), as well as those with three-column fractures, who had a median KOOS of 83 (IQR: 22.9) and median HSS score of 90 (IQR: 10.5). The differences in KOOS scores were statistically significant, χ^2 (2, n=49) =10.02, p=0.007, as

TABLE I
Demographic information and trauma mechanism of injury

	AO classification				Schatzker classification				Three column classification						Total	
	Type B (n=21)		Type C (n=28)		Low energy type 1-2-3 (n=21)		High energy type 4-5-6 (n=28)		1 Column (n=26)		2 Column (n=9)		3 Column (n=14)		(n=49)	
Demographic variables	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Age (year) (Mean±SD)	5±14		40.6±10		41.1±13		39.9±10		39.6±13		42.3±10		40.7±9		40.6±11	
Sex																
Male	6	76	22	78	17	77	21	75	20	77	7	77	11	78	38	77
Female	5	24	6	22	4	23	7	25	6	23	2	23	3	22	11	23
Trauma type (%)	21	42.9	28	57.1	21	42.9	28	57.1	26	53.1	9	18.4	14	28.6		
Motorcycle accident	8	16.3	8	16.3	8	16.3	8	16.3	8	16.3	3	6.1	5	10.2	16	32.7
Pedestrian accident	3	6.1	5	10.2	3	6.1	5	10.2	3	6.1	2	4	3	6.1	8	16.3
Domestic accident	4	8.1	4	8.1	4	8.1	4	8.1	6	12.2	1	2	1	2	8	16.3
Car accident	3	6.1	4	8.1	3	6.1	4	8.1	5	10.2	1	2	1	2	7	14.3
Gunshot	1	2	3	6.1	1	2	3	6.1	2	4	0	0	2	4	4	8.2
Falling from high	2	4	1	2	1	2	2	4	2	4	0	0	1	2	3	6.1
Work accident	0	0	2	4	0	0	2	4	0	0	1	2	1	2	2	4.1
Violence	1	2	0	0	1	2	0	0	0	0	1	2	0	0	1	2
Smoking																
Yes	8	38	16	38	8	38	16	38	11	42	6	66	7	53	24	50
No	13	62	11	62	13	62	11	62	15	58	3	33	6	47	24	50

SD: Standard deviation.

TABLE II
KOOS and HSS scores by fracture types

	KOOS Score			HSS Score		
Fracture types	Median	IQR	Statistical values	Median	IQR	Statistical values
AO classification						
Type B	92	9.3	z= –2.47, p=0.013	96	4	z= –2.70, p=0.007
Type C	82.5	22.9		90	11	
Schatzker classification						
Type 1-2-3 (Low energy)	92	10.8	z= –2.22, p=0.026	96	5.5	z= –2.50, p=0.012
Type 4-5-6 (High energy)	83	19.8		90	11	
Three column classification						
1 Column	92.5	12.1	χ^2 (2, n=49)=10.02, p=0.007	96	4.3	χ^2 (2, n=49)=13.38, p=0.001
2 Column	83	47.1		89	32	
3 Column	83	22.9		90	10.5	

KOOS: Knee Injury and Osteoarthritis Outcome Score; HSS: Hospital for Special Surgery; IQR: Interquartile range; Statistical values include z-test or chi-squared test results; p indicates the significance level.

were the differences in HSS scores, χ^2 (2, n=49) =13.38, p=0.001 (Table II).

Patients with one-column fractures showed a median ROM value of 130° (IQR: 16), and patients with three-column fractures had a median ROM value of 130° (IQR: 20). In contrast, patients with two-column fractures exhibited a significantly lower median ROM of 120° (IQR: 37.5), as indicated by χ^2 (2, n=49) =7.67, p=0.022. No significant relationship was found between the Schatzker and AO classification systems and the ROM (p=0.93 and p=1, respectively).

The relationship between KOOS and HSS knee scores and knee ROM was investigated. The KOOS score had a weak-moderate correlation with ROM (r=0.38, p=0.007), and the HSS score had a moderate correlation with ROM (r=0.44, p=0.002). Figure 1 presents the relation between HSS scores and ROM according to the three-column classification.

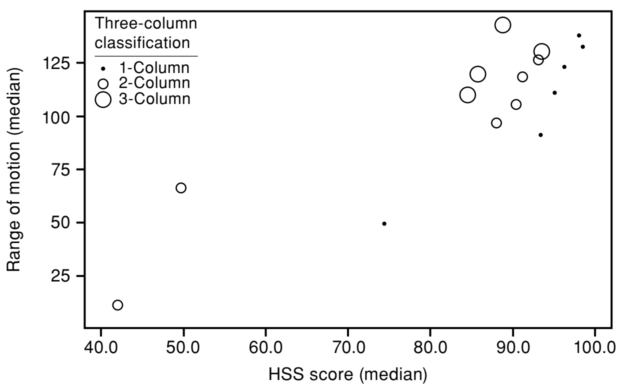

FIGURE 1. Relation between HSS scores and ROM according to the three-column classification.
HSS: Hospital for Special Surgery; ROM: Range of motion.

In the Schatzker classification system, patients with type 1, 2, and 3 (low-energy) fractures had a significantly shorter median hospital stay (9 days; IQR: 5.5) compared to patients with type 4, 5, and 6 (high-energy) fractures, whose median hospital stay was 12.5 days (IQR: 14). The difference in hospital stay was statistically significant, with z= –2.41 and p=0.016. In the AO classification system, there was no significant difference between the median hospital stay of type B fractures (9 days; IQR: 6.5) and type C fractures (12 days; IQR: 14), with z= –1.81 and p=0.70. Lastly, according to the three-column classification, a median hospital stay of nine days (IQR: 11.2) was observed for patients with one-column fractures, while those with two-column fractures had a median stay of 11 days (IQR: 12), and patients with three-column fractures had a median stay of 12.5 days (IQR: 10.5). There was no statistically significant difference among the groups (χ^2 [2, n=49] =1.20, p=0.548).

In the case of the AO classification system, we observed that type B fractures were linked to a median thigh atrophy of 1 cm (IQR: 1), whereas type C fractures demonstrated a median atrophy of 1 cm (IQR: 1), with z= –2,36 and p=0.018. According to the Schatzker classification, it was found that low-energy fractures were associated with a median thigh atrophy of 1 cm (IQR: 1), while high-energy fractures exhibited a median atrophy of 1 cm (IQR: 1), with z= –2.29 and p=0.022. The median thigh atrophy

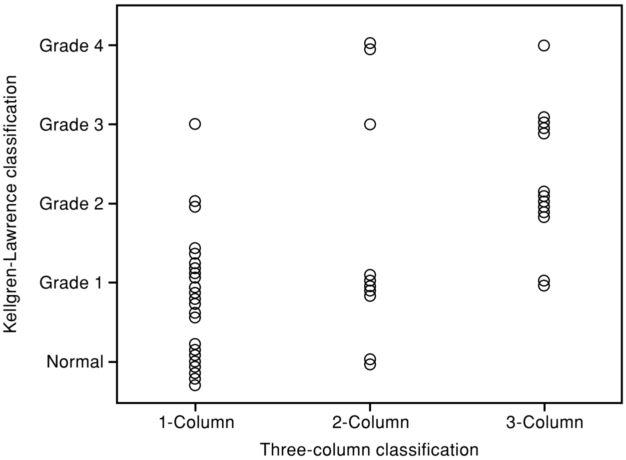

FIGURE 2. The relationship between the three-column classification and the Kellgren-Lawrence classification, development of osteoarthritis.

for patients with one-column fractures was 1 cm (IQR: 1.1), whereas it was 1 cm (IQR 2) for those with two-column fractures and 1 cm (IQR: 1.5) for those with three-column fractures. Upon analyzing the fractures using the three-column classification system, no statistically significant differences in thigh atrophy were observed among the groups (χ^2 [2, n=49] =3.00, p=0.223).

According to the AO classification system, it was observed that the median operation time for type B fractures was 2 h (IQR: 1), whereas it was 3 h (IQR 0.63) for type C fractures. The results showed that type C fractures had a significantly longer operation time than type B fractures (z= –2.80, p=0.005). Upon evaluating the fractures according to the Schatzker classification system, it was observed that the median operation time for low-energy fractures was 2 h (IQR: 1.1), whereas it was 3 h (IQR: 1) for high-energy fractures (z= –2.38, p=0.017). The median operation time for one-column fractures was 2 h (IQR: 1.3), whereas it was 2.7 h (IQR: 1) for two-column fractures and 2.5 h (IQR 1.1) for three-column. However, when fractures were analyzed according to the three-column classification system, no statistically significant differences in operation time were found among the groups (χ^2 (2, n=49) =1.31, p=0.519).

In this study, osteoarthritis development was analyzed using the Kellgren-Lawrence classification. According to the AO classification system, it was

TABLE III
Functional scores, ROM, and osteoarthritis progression in non-anatomic *vs.* anatomic groups

	Non-anatomic		Anatomic		
Reduction	Median	IQR	Median	IQR	Statistical values
KOOS	85.4	20	87.6	12.8	z= –0.79, p=0.431
HSS	91.5	10.3	95	8.8	z= –1.55, p=0.119
Range of motion	120	35	130	10	z= –1,49, p=0.134
Follow-up X-ray, (Kellgren-Lawrance grade)	2	1	1	1	z= –4.49, p<0.001

ROM: Range of motion; IQR: Interquartile range; KOOS: Knee Injury and Osteoarthritis Outcome Score; HSS: Hospital for Special Surgery; Statistical values include z-test test results; p indicates the significance level. Anatomic reduction: articular surface incongruencies <2 mm.

TABLE IV
Clinical outcomes that AO, Schatzker, and three-column classifications provide

	AO		Schatzker		Three-column	
	Info	*p*-value	Info	*p*-value	Info	*p*-value
Functional scores						
KOOS	+	**0.013**	+	**0.013**	+	**0.007**
HSS	+	**0.007**	+	**0.026**	+	**0.001**
Range of motion	-	0.93	-	1	+	0.022
Hospital stay	-	0.70	+	**0.016**	-	0.548
Thigh atrophy	+	**0.018**	+	**0.022**	-	0.223
Operation time	+	**0.005**	+	**0.017**	-	0.519
Follow-up X-ray (Kellgren-Lawrance)	+	**0.039**	-	0.066	+	**<0.001**

KOOS: Knee Injury and Osteoarthritis Outcome Score; HSS: Hospital for Special Surgery; Info: information, *p* indicates the significance level.

TABLE V
Regression analysis results of variables associated with KOSS score

				%95 CI		
	B	SE	Beta	LL	UL	*p*
Smoking	–17.801	5.879	–0.473	–29.692	–5.911	**0.004**
Sex	–7.034	7.360	–0.159	–21.921	7.853	0.345
Age	–3.329	2.581	–0.183	–8.551	1.892	0.205
Open wound (Gustillo Anderson)	–0.331	0.223	–0.211	–0.782	0.121	0.147
Treatment type	–2.471	2.671	–0.133	–7.873	2.931	0.360
Bone graft	–3.835	6.109	–0.094	–16.192	8.522	0.534

KOOS: Knee Injury and Osteoarthritis Outcome Score; CI: Confidence interval; B: Unstandardized regression coefficient; SE: Standard error; LL: Lower limit; UL: Upper limit; *p* indicates the significance level.

TABLE VI
Regression analysis results of variables associated with HSS score

				%95 CI		
	B	SE	Beta	LL	UL	*p*
Smoking	–11.424	3.327	– 0.505	–18.153	–4.695	**0.001**
Sex	–2.780	4.165	– 0.105	–11.204	5.644	0.508
Age	–1.887	1.461	– 0.173	–4.842	1.068	0.204
Open wound (Gustillo Anderson)	–0.253	0.126	– 0.269	– 0.509	0.002	0.052
Treatment type	–2.527	1.511	– 0.226	–5.584	0.530	0.103
Bone graft	1.209	3.457	0.049	–5.784	8.201	0.729

KOOS: Knee Injury and Osteoarthritis Outcome Score; CI: Confidence interval; B: Unstandardized regression coefficient; SE: Standard error; LL: Lower limit; UL: Upper limit; *p* indicates the significance level.

observed that the median Kellgren-Lawrence grade for type B fractures was 1 (IQR: 1), and for type C fractures, it was 1 (IQR: 1.25; z= –2.07, p=0.039). Low-energy fractures had a median Kellgren-Lawrence grade of 1 (IQR: 1.5), and there was no statistically significant difference compared to high-energy fractures, which had a median Kellgren-Lawrence grade of 1 (IQR: 1; z= –1.83, p=0.066). Lastly, according to the three-column classification, a median Kellgren-Lawrence grade of 1 (IQR: 2) was observed for patients with one-column fractures, while those with two-column fractures had a median grade of 1 (IQR: 3), and patients with three-column fractures had a median grade of 2 (IQR: 1) (χ^2 (2, n=49) =16.23, p<0.001). The relationship between the three-column classification and the Kellgren-Lawrence classification is shown in Figure 2.

Table III presents the functional scores, ROM, and osteoarthritis development status between the groups with achieved anatomical reduction (articular surface incongruencies <2 mm) and those without. Table IV shows which clinical outcomes the AO, Schatzker and three-column classifications provide information about. The analysis of other variables that could impact KOOS and HSS scoress is presented in Tables V and VI. Additionally, when examining the relationship between smoking and functional scores individually, the median KOOS score for nonsmokers was 91 (IQR: 13), and the HSS score was 96 (IQR: 5.8). Smokers exhibited a median KOOS score of 85.5 (IQR: 48) and an HSS score of 89 (IQR: 11). These results indicate that nonsmokers attained higher KOOS (z= –2.289, p=0.022) and HSS (z= –3.300, p=0.001) scores compared to smokers.

DISCUSSION

This study aimed to investigate the prognosis and functional consequences of tibial plateau fractures, with a specific focus on evaluating the predictive utility of these three classification systems for patient outcomes. Existing literature predominantly focuses on comparing the reliability of classification systems.[10] Two studies suggest the superiority of three-dimensional evaluations.[11,12] However, as indicated in our study, there is no perfect classification system; all three classification systems impart information on different aspects.[13]

In this study, it was observed that across all three classification systems, as the fracture category and complexity increased, patients demonstrated lower functional scores. Conversely, simpler and lower-energy fractures, such as AO type B fractures, Schatzker type 1, 2, and 3 fractures, and type 1 column fractures exhibited higher functional scores. In one of the most comprehensive studies on this topic, conducted by Rademakers et al.,[3] fractures were classified according to both the AO and Schatzker classification systems. Their findings revealed that AO type C fractures and Schatzker type 4 fractures obtained the lowest functional scores. Their study demonstrated that more complex fractures tended to result in poorer functional scores.

In a study conducted by Hap and Kwek[14] functional scores (Short Form-36) decreased as fracture complexity and trauma severity increased (p=0.004). However, this study exclusively employed the Schatzker classification, and no classifications based on other systems were performed. Additionally, a more generalized scoring system was utilized. In contrast to these studies in the literature, there are opposing studies conducted by Rosteius et al.,[15] which indicate that there is no significant difference in functional scores between AO type B fractures and type C fractures (p=0.340 and p=0.274, respectively).

In the literature, where generally only one classification system is used, our study involved the comparison of three different classification systems and the utilization of two distinct knee-specific scoring systems.[16-18] In this study, when comparing fracture classification with ROM, it is observed that only the three-column classification provides information in this regard. However, unlike functional scores, it has been determined that the most complex fracture does not necessarily have worse ROM. Patients with two-column fractures have lower ROM compared to those with the most complex fractures.[18]

In a study conducted by Li et al.,[19] they stated that there was a significant relationship between Schatzker classification and ROM. They found that patients with Schatzker type 5 and 6 fractures had limited ROM as an independent factor (odds ratio= 2.52, 95% confidence interval 1.16-5.47, p=0.019). In this study, only the Schatzker classification was used. However, in our study, we could not find a relationship between Schatzker classification and ROM (p=1).

Regaining previous muscle strength can take a long time for patients after a tibial plateau fracture. In a study conducted with 51 patients, only 14% of patients were able to have normal quadriceps muscle strength after 12 months.[20] The study by Pun et al.[21] demonstrated that patients with Schatzker type 5 and 6 fractures had 1.5 cm of atrophy on average. In our study, thigh atrophy was found to be significantly different between low-energy and high-energy fractures in the Schatzker classification system (p=0.022) and between type B and type C fractures in the AO classification system (p=0.018). However, no significant differences were found among the groups in the three-column classification system.

In this study, when assessing the progression of osteoarthritis in patients through radiological evaluation, better radiological outcomes were achieved in simpler and low-energy fractures according to the AO and three-column classifications. Additionally, it was observed that patients with anatomically reduced fractures had less osteoarthritis development radiologically. However, no relationship was found between anatomical reduction and functional scores.

In the study conducted by Jagdev et al.,[22] a significant relationship was found between Schatzker classification and the development of osteoarthritis (p=0.01). However, in contrast to our study, they used a single classification system, and a scoring system was also used.

In their review, Marsh et al.[23] noted that there was little correlation between clinical outcomes and anatomical reduction. They stated that the most important factor influencing the development of osteoarthritis is cartilage damage at the time of injury. Most of the patients in our study did not develop advanced osteoarthritis. However, when we look at the literature, this rate is expected to increase in long-term (20-year) follow-ups.[24]

Canadian Orthopaedic Trauma Society[25] conducted a multicenter, prospective, randomized clinical trial in which they compared open reduction internal fixation with external fixation for bicondylar tibial plateau fractures. The study demonstrated that there was no statistically significant difference in the HSS score at the two-year follow-up (p=0.307). Similarly, in this study, no statistically significant difference was found between the treatment method and the KOOS and HSS scores. This suggests that the classification of the fracture could provide information about the fracture prognosis, independent of the treatment applied.

Our study also revealed several factors that did not significantly impact KOOS and HSS scores, such as the sex, age, treatment type, and the use of bone grafts. However, we found that nonsmokers had statistically higher KOOS and HSS scores compared to smokers, highlighting the potential negative impact of smoking on functional outcomes. Our result showed similar age, sex, and hospitalization time with the literature.[26-28]

The limitations of our study include its retrospective design and the fact that it was conducted at a single center. Additionally, the sample size of our study is limited to perform detailed analyses for all subgroups. Therefore, more general groups were used. Similarly, in the literature, more general groups were used due to the inability to obtain a sufficient number of patients from all subgroups. As a result, the data had a nonparametric distribution, which represents a weakness in our study. Future studies should aim to include larger and more diverse patient samples to allow for detailed subgroup analyses. Additionally, conducting multicenter prospective research across different healthcare facilities can enhance the generalizability of results. Furthermore, investigations should delve deeper into various variables, such as lifestyle factors, overall health status, treatment methods, and medication usage, to provide a comprehensive understanding of their impacts on outcomes literature.

In conclusion, each system provides unique insights into different outcomes. The data show significant correlations between all fracture classifications and functional outcomes. Notably, the three-column system provided valuable insights into postoperative ROM, and the Schatzker classification system effectively estimated hospital stay. Importantly, fracture classification prognostic utility appears independent of the treatment applied in this study. Lastly, nonsmokers exhibited superior functional outcomes, emphasizing the need to consider patient lifestyle factors in treatment planning.

Ethics Committee Approval: The study protocol was approved by the Trakya University Faculty of Medicine Scientific Research Ethics Committee (date: 21.05.2018, no: 09/13). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Idea/concept and design: E.S.; Data collection and/or processing: E.S.; Control/supervision and analysis and/or interpretation: C.Ç., M.E., E.S.; Literature review: E.S., M.E.; Writing the article: E.S. Critical review: M.Ö., M.Ç., References and fundings: E.S, C.Ç.; Materials: M.Ç., M.Ö.

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