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Cohort Study

Injuries associated with golf: A qualitative study

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ABSTRACT

Background: Golf is a popular sport played worldwide. The majority of professional golfers work as teaching professionals based at golf clubs. All professional players spend numerous hours on the golf course, placing themselves at increased risk of injury. There have been no recent, large studies investigating injury patterns among male and female professional golfers.

Objective: To investigate the frequency, types and mechanism of injury sustained by male and female professional golfers and to compare injury patterns between touring and teaching professionals.

Methods: Injury data was analyzed from 77 amateur golfers recruited through a questionnaire asking about their different injuries. A web based survey was conducted focusing on injury frequency, location and mechanism and any subsequent time loss. Factors such as side of injury, investigations for the injury were noted.

Results: The study enlisted the participation of 76 patients. One was excluded due to incomplete questionairres Injuries were reported by 34 patients (45%). Eleven patients said they had an elbow injury. The relationship between the number of years the individuals had been playing golf and their history of injury was shown to be significant ($p = 0.0257$). Warm up and injury have a statistically significant relationship ($p = 0.846$).

Conclusion: In order to contribute to making golf a safer and hence more enjoyable lifetime activity, a greater knowledge of golf-related injuries is required. This study attempts to do so, and the elbow was discovered to be the most damaged region.

1. Introduction

For a large number of people, golf is a fun hobby. It's a one-of-a-kind sport in that anyone of any age, gender, or athletic skill can participate [1]. The popularity of golf has increased in recent years due to the rise of young professional golfers [2].

A golf simulator [3] provides visual input to allow players to replicate the experience of playing golf in an indoor setting. Golfers created it in the 1970s to allow them to practice their sport regardless of the weather or time of day. South Korea boasts the most golf simulators per capita in the world, as well as the most modern simulator designs. In reality, the screen golf was initially used for swing analysis and winter training, but it has since evolved into a part of sports culture and is dedicated to popularizing golf. In 2009, the screen golfers accounted for 1.27 million persons out of the 2.1 million golfers in the country, while the field golfers accounted for over 1.25 million. The number of screen golfers increased by 32% over the previous year, after reaching a new high of 21% in 2008. In other words, it is not an exaggeration to say that screen golf has contributed to the growth of the total golf population in the United States [4]. The number of golfers worldwide was projected to be over 25 million in 2000, and this figure is predicted to rise to 55 million by 2020 [5,6], without considering the number of golfers who would play screen golf. In the future, senior golfers will make up a larger percentage of the overall golf population. The average golfer is older

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than those who participate in other sports, which is a benefit that golf provides. To some extent, the ageing process does not exclude great performance and competence in golf. As a result, a golfer's career can last more than 50 years, and a person can begin playing golf at an age when they would otherwise be compelled to stop participating in other sports [2]. In other words, because golf can be played by everyone, older people will play it. The elderly, on the other hand, will be damaged as a result of degenerative processes, especially when paired with the pressures generated by golf swings [1]. Then, perhaps older folks shouldn't be playing golf at all. The patterns of damage are unique to certain types of activity, and this is especially true in sports [7]. Severe hemarthrosis, for example, is very frequent among soccer players. Ankle injuries are particularly prevalent among basketball players [8]. The swing mechanism in golf creates a massive amount of force. The swing mechanism in golf creates a massive amount of force. Axially twisting has been recognized as a risk factor for low back problems on its own [9,10]. During a golf swing, the lumbar spine is also subjected to substantial compression, anterior-posterior shearing, torsion, and lateral bending stresses [1,11]. Most research on sports-related injuries have concentrated on professional or amateur players in other sports [12,13], while recreational golfers, who incur more injury than professional and amateur golfers, have received relatively less attention. As a result, the major objective of this study was to conduct a survey-based investigation of various musculoskeletal issues among recreational golfers. The second aim was to look at the link between training volume, warm-up, injury causes, and swing types in amateur golfers.

2. Materials and methods

This is a survey-based research that took place among 77 amateur golfers at a well-known country club in Lahore, Pakistan. Each participant was given an internet questionnaire form to complete. We investigated and questioned the participants' willingness to participate in our survey before they gave comments. Over the course of six months, from March 2020 to September 2020, we collected data on golfers' personal information. All of the methods were thoroughly described to the subjects by the investigators. Among the 77 subjects, 75 were male and 2 were female with a mean age of 47.38 ±14.27 with a median of 45. 53 considered themselves as competent golfers, 14 were beginners while 9 were experts.

Each subject was asked to fill in a pre-designed questionnaire and submit it electronically to authors. Patients who gave written informed consent completed a self-report questionnaire. The self-report questionnaire included personal data (name, age, gender, height, weight), golf career, golf training volume (intensity, frequency, time), type of swing responsible for injury (driver, long iron, middle iron, or short iron), injury types (fracture, sprain, strain, or cartilage rupture), and anatomic distribution of injury (neck, upper back, lower back, hip, ankle & foot, shoulder, elbow, or wrist & hand).

Data were analyzed using the IBM SPSS version 26. Tests used for analysis were chi square to see relationship of skill and type of injury. Fisher exact test was used to analyze association between competence level and intervention requirement. P value of<0.05 was considered significant.Our research was fully complaint with the criteria set out by O, Brien et al. [22]. UIN on research registry7944.

3. Results

A total of 76 participants were included in the study. One questionnaire was excluded due to incomplete forms. 34 patients reported injury (45%). 42 patients (55%) did not report an injury.

Among patients who reported injury the number of times they had sustained an injury are listed below in Table 1.

Among patients who were injured, the numbers and percentages of patients by site of injuries are listed below in Table 2.

A chi-square test of independence was carried out to examine the relationship between competence level (beginner, competent and expert-self reported) and occurrence of injury (presence or absence of golf-related injury in past). 26%(11) of beginners had never been injured, 79%(27) of competent and 12%(5) of expert players reported never being injured as well. The relationship between these variables was not significant, X2(2, N = 76) = 3.9025, p = 0.142 (Table 3).

The proportion of players who sustained an injury did not differ with the type of swing they perform during the play (i.e., classic swing, hybrid swing or modern swing) X2(2, N = 76) = 0.7918, p = 0.673 with classic swing players reporting 44% injuries and modern swing 32% injuries as shown in Table 4.

A chi-square test of independence was used to show a significant association between history of injury and number of years that the subjects had been playing golf for, p = 0.0257 with 61% of the players having played for more than 6 years. Out of 34 players who had reported injury, 27(79%) of the players had more than 6 years of experience in the game (Table 5). Patients playing golf for less than one year were less likely to sustain injuries compared to patients playing longer.

When comparing association between occurrence of injury and increasing number of hours normally spent playing golf by players Chi-square test of independence was used. 4(5%) players reported spending less than an hour on the course while 26(34%) reported each golfing session lasting longer than 3 h. Out of the 26 players 14 reported getting injured during golf. Our analysis failed to show any significance, p = 0.6195.(Table 6).

A chi-square test of independence was performed to examine the association between whether the players warmed up or not and occurrence of injury. 19 (56%) of players reported warming up reported injury compared to 26%who did not warm up. The difference was statistically significant (p = 0.00846)(Table 7).

When chi-square test of independence was used to compare the association between occurrence of injury and the frequency players hitting the ground with golf stick during play, it failed to show significance (p = 0.454). 5 (6%) patients reported never hitting ground during play compared to 38 (50%) who reported hitting ground multiple times during each session (Table 8).

Table 1
Frequency of injuries in injured patients.

Number of times patient was injured playing golf	Number of patients (%)
	Total = 34
1-3 times	31 (91%)
3-6 times	3 (9%)
>6 times	0

Table 2
Proportion of patients by site of injury.

Site of injury	Number of patients (%)- Total = 34
Wrist	10 (29%)
Elbow	11 (32%)
Shoulder	6 (18%)
Back	7 (21%)

Table 3
Relation between competence and injury occurrence.

Variable	Total,n (%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Competence level					0.142
Beginner	14 (18.5)	3 (9)	11 (26)	3.9025	
Competent	53 (69.7)	27 (79)	26 (62)		
Expert	9 (11.8)	4 (12)	5 (12)		

Table 4
Analysis of relation between type of swing and injury sustained.

Variable	Total,n (%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Swing type					0.67
Classic swing	33 (43)	15 (44)	18 (43)	0.792	
Hybrid swing	15 (20)	8 (24)	7 (17)		
Modern swing	28 (37)	11 (32)	17 (40)		

Table 5
Association between History of injury and number of years played.

Variable	Total,n (%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Overall time of playing golf (in years)					0.0257
Less than 1 year	9 (12)	2 (6)	7 (17)	9.287	
1–3 years	14 (18)	3 (9)	11 (26)		
3–6 years	7 (9)	2(6)	5 (12)		
More than 6 years	46 (61)	27 (79)	19 (45)		

Table 6
Association between occurrence of injury and hours played.

Variable	Total,n (%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Time spent playing golf in a single session (in hours)					0.619
Less than 1 h	4 (5)	1 (3)	3 (7)	1.78	
1–2 h	8 (11)	3 (9)	5 (12)		
2–3 h	38 (51)	16 (47)	22 (52)		
More than 3 h	26 (34)	14 (41)	12 (29)		

Table 7
Association between warming up pre-game and incidence of injury.

Variable	Total,n (%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Warming up before play					0.00846
Warms up	30 (39.5)	19 (56)	11 (26)	6.93	
Does not warm up	46 (60.5)	15 (44)	31 (74)		

Chi-square test of independence was used to check significance value between twisting back during golf play swing and history of number injuries sustained related to golf. 14%(11) of players never reported never swinging their back where as 38%(29) reported swinging their back on multiple occasions. A higher percentage of patients who swung their back multiple times during each session reported a higher incidence of injury. There was a significant association seen between the variables (P = 0.024) (Table 9).

There was no significant association seen between occurrence of injury and the frequency players overswing with golf stick during play (p = 0.317) (Table 10). 6 players (8%) reported never overswinging during play compared to 28 players (37%) who reported doing so multiple times in each session.

In patients who had sustained injuries related to golf, Fisher exact test for count data was used to examine if their self-reported competence level was associated with severity of injury (based on whether the patient required imaging or intervention for the injury). A Fisher exact test did not find a significant association between self-reported competence level and requirement of imaging for the injury (p = 0.468). A Fisher exact test performed to examine association between self-reported competence level and requirement for interventions also failed to show a significant association (p = 0.5112).(Table 11).

Table 8
Association between occurrence of injury and frequency of hitting golf club during play.

Variable	Total,n(%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Frequency of hitting ground during play					0.454
Never	5 (6)	1 (3)	4 (9.5)	3.66	
At least once a month	18 (24)	7 (20)	11 (26)		
At least once a week	6 (8)	2 (6)	4 (9.5)		
Once a session	9 (12)	6 (18)	3 (7)		
More than once a session	38 (50)	18 (53)	20 (48)		

Table 9
Association between twisting back during swing and injury sustained.

Variable	Total,n(%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Frequency of twisting while playing golf					0.024
Never	11 (14)	2 (6)	9 (21)	11.23	
At least once a month	19 (25)	10 (30)	9 (21)		
At least once a week	5 (7)	4 (11)	1 (2)		
Once a session	12 (16)	2 (6)	10 (24)		
More than once a session	29 (38)	16 (47)	13 (30)		

Table 10
Association between occurrence of injury and overswing.

Variable	Total,n (%)	Injury reported		Chi square statistic	p-value
		Yes, n (%)	No, n (%)		
Total	76	34	42		
Frequency of overswinging during playing golf					0.317
Never	6 (8)	1 (3)	5 (12)	4.72	
At least once a month	23 (30)	8 (23)	15 (36)		
At least once a week	7 (9)	3 (9)	4 (10)		
Once a session	12 (16)	6 (18)	6 (14)		
More than once a session	28 (37)	16 (47)	12 (28)		

4. Discussion

The goal of this study was to examine the various injuries that occur in golfers of various skill levels during a six-month period. The current research gathered information on age, gender, playing level, and

Table 11
Association between competence level and severity of injury needing imaging and intervention.

Level of competence	Total, n (%)	Required, n (%)	Not required, n(%)	P-value (from Fisher Exact test)
	34			
Imaging required?				0.468
Beginner	3 (9)	0 (0)	3 (14)	
Competent	27 (79)	11 (85)	16 (76)	
Expert	4 (12)	2(15)	2 (10)	
Intervention required?				0.5112
Beginner	3 (9)	0	3 (9.5)	
Competent	27 (79)	2 (67)	25 (81)	
Expert	4 (12)	1 (33)	3 (9.5)	

reported injuries. This study also aimed to expand on past studies in the field while also looking at fresh data that might help with the knowledge of golfing injuries. In contrast to past similar research [14], the current study covers both males and females.

There is relatively little literature on golfing injuries during a six-month period currently available. The majority of research have focused on injury rates throughout the course of a person's career, which is subject to recollection bias and may not be a reliable indicator of injury rates.

When comparing injury site and kind, the elbow was the most commonly damaged among the participants, while the shoulder was the least impacted. Our findings support earlier research [14,16,17], which found that the wrist and lower back are both often impacted in injured golfers. Our study showed that 7(34%) players reported having back injuries. This is consistent with other studies done in the past [14,20,21]. It's worth noting that, while low back discomfort is frequent among golfers in this research and many others, it's also common among non-golfers. Shoulder injuries (18%) were also common in this study and in previous studies [14,18,19]. Despite the fact that all studies have identified shoulder injuries, there has been a little disparity in the prevalence of injuries in this area. The shoulder was injured 16.8% of the time, according to Fradkin et al. [14]. However, in a paper by Jobe et al. [19], which looked at data from professional golfers on the senior PGA tour over a five-year period, just 7.7% were recorded. However, the fact that Fradkin utilised female pennant players whereas Jobe used PGA pros might explain this in some manner.

Unlike earlier research, this one looked at a wide range of competence, which is important for determining the injury rate of golfers. Although the majority of the players in our research were proficient (79%), we were unable to determine the player's exact handicap. It was feasible to see if there was a link between ability and injury type using a range of playing skills. In this sample, however, there was no substantial connection between these characteristics. Although a link between amount of skill and injury type was discovered ($p = 0.142$), it was not deemed strong enough to warrant remark. A bigger research group might be employed in the future to gain a greater knowledge of this element of the link between golfing injuries and level of play, particularly in terms of injury type.

The total injury rate in this research (44%) was greater than the 35.2% reported by Fradkin et al. [14].

The sample size in this study was primarily male, whereas the other study [14] exclusively questioned female pennant players. Interestingly, despite the fact that the research populations were different, the outcomes only differed by 9%. Another research [15] on amateur golfers in the United Kingdom found a somewhat higher injury rate of 57%. The mean age of participants in this study (49.5 years) and in our study (47.4 years) is comparable. Our total injury rate, while close to that of Fradkin et al. [14], remained relatively low when compared to injury rates reported in a study of amateur golfers in the United States (62%) [16]. Other than a difference in study population, the different rate of damage in this study is difficult to explain.

It's worth noting that several of the golfers in this research said they'd had multiple injuries. In fact, throughout the course of six months, 31 (91%) of the 34 affected individuals reported having one or more damaged areas.

The usage of a warm-up before play, as well as the length of the warm-up utilised prior to practise or play, was studied in this study, as well as the influence on injury rates. According to Fradkin et al. [17], a golfer's performance is considerably enhanced by following a golf-specific warm-up routine as opposed to not doing so. Only 39.5% tried any sort of warm-up, while 60% did not warm up before their game, according to this research.

Aside from the warm-up, there are a number of other injury-prevention methods that a club golfer might employ. Injury prevention by study and modification of the golfer's real swing, according to some studies [14], may be beneficial in preventing some injuries. It's probable that golfers with a biomechanically weak golf swing are more prone to put specific parts of their bodies under stress, thus increasing their risk of injury.

The current research has a number of limitations. This study included a small number of participants. In the future, we intend to conduct a research with additional participants. One aspect of our questionnaire that was left out was asking individuals about their disability. Muscle tension and the amount of minutes spent warming up by players were not adequately investigated. The majority of our inquiries were based on the players' previous memories. It's also worth noting that using a prospective research design may have resulted in more accurate results because recollection bias would not have been an issue.

5. Conclusion

It is possible to determine whether or not injuries occur during the practise or play of golf. Furthermore, these injuries affect a wide range of athletes, including those of varying ages, gender, and skills. It is necessary to have a better understanding of golf-related injuries in order to contribute to making golf a safer and hence more pleasurable lifetime sport. This study, as well as prior studies, tries to do this. It has been shown that golf injuries may occur, including significant musculoskeletal injuries. The elbow was shown to be the most prevalent site of injury in this research group, with the majority citing muscle tightness or strain as the main source of discomfort. Further study into areas like core stabilisation techniques, improved warm-up procedures, and general strength and conditioning training programmes might be useful in terms of preventing this sort of injury.

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Nil.

Ethical approval

Retrospective study looking at patient notes so no ethical approval needed.

Consent

All data anonymised.

Registration of research studies

1. Name of the registry:
2. Unique Identifying number or registration ID:
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

Guarantor

Mohammad Noah H Khan corresponding author.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Author contribution

Miss Ammal Qureshi: lead author idea and write up. Mr Mohammad Noah H Khan: data collection and write up. Dr Hamayle Saeed: data collection. Mr Bakht Yawar: data analysis. Dr Mariam Saghir: proof reading and corrections of statistics. Dr Misbah Malik: data collection and analysis. Dr Arif H Khan: supervising consultant.

Declaration of competing interest

Nil.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.103899.

References

[1] G.S. Gluck, J.A. Bendo, J.M. Spivak, The lumbar spine and low back pain in golf: a literature review of swing biomechanics and injury prevention, Spine J. 8 (2008) 778–788.
[2] G. Gosheger, D. Liem, K. Ludwig, O. Greshake, W. Winkelmann, Injuries and overuse syndromes in golf, Am. J. Sports Med. 31 (2003) 438–443.
[3] http://en.wikipedia.org/wiki/Indoor_golf.
[4] Sports World, 65% of domestic population enjoys the screen golf. www.sportsworldi.com, 2010.
[5] The National Golf Foundation. "Frequently asked questions about the game and business of golf in the US", The National Golf Foundation Web Site. Available at. http://www.ngf.org/cgi/whofaq.asp. 2003.
[6] SRI International. "The golf economy report", SRI International Web Site. Available at. http://www.golf2020.com/reports_2002GolfEconomy.asp2002.(PDF)Golf and Injury Incidence in Recreational Golfers: A Retrospective Study.
[7] T. Ohdera, M. Tokunaga, S. Hiroshima, E. Yoshimoto, S. Matsuda, Recurrent hemarthrosis after knee joint arthroplasty: etiology and treatment, J. Arthroplasty 19 (2) (2004) 157–161.
[8] D.F. Messina, W.C. Farney, J.C. Delee, The incidence of injury in Texas high school basketball: a prospective study among male and female athletes, Am. J. Sports Med. 27 (1999) 294–298.
[9] W.S. Marras, K.P. Granata, A biomechanical assessment and model of axial twisting in the thoracolumbar spine, Spine 20 (1995) 1440–1451.
[10] H.F. Farfan, J.W. Cossette, G.H. Robertson, R.V. Wells, H. Kraus, The effects of torsion on the lumbar intervertebral joints: the role of torsion in the production of disc degeneration, J. Bone Joint Surg. 52 (1970) 468–497.
[11] C.N. Stover, J.R. McCarroll, W.J. Mallon, Feeling up to Par: Medicine from Tee to Green, FA Davis, Philadelphia, 1994.
[12] R. Johson, C. Ettlinger, Alpine ski injuries: changes through the years, Clin. Sports Med. 1 (1982) 182–197.
[13] F. Pettrone, E. Ricciadelli, Gymnastic injuries: the Virginia experience 1982-1983, Am. J. Sports Med. 1 (1987) 59–62.
[14] A.J. Fradkin, P.A. Cameron, B.J. Gabbe, Golf Injuries- common and potentially avoidable, J. Sci. Med. Sport 8 (2) (2005) 163–170.
[15] B.E. Batt, A survey of golf injuries in amateur golfers, Br. J. Sports Med. 26 (1) (1992) 63–65.
[16] J.R. MaCarroll, A.C. Retting, K.D. Shelbourne, Injuries in the amateur golfer, Physician Sportsmed. 18 (1990) 122–126.
[17] A.J. Fradkin, C.F. Finch, C.A. Sherman, Warm up practices of golfers: are they adequate, Br. J. Sports Med. 35 (2001) 125–127.
[18] T.J. Noonan, W. Mallon, J. Golf, Principles and Practice of Primary Care Sports Med, Lippincott Williams & Wilkins, USA, 2001, pp. 493–497 (Chapter 41).
[19] F.W. Jobe, M.M. Pink, Shoulder pain in golf, Clin. Sports Med. 15 (1) (1996) 55–63.
[20] J.R. McCarroll, The Frequency of golf injuries, Clin. Sports Med. 15 (1) (1996) 1–7.
[21] P. Grimshaw, A. Giles, R. Tong, K. Grimmer, Lower back and elbow injuries in golf, Sports Med. 32 (10) (2002) 655–666.
[22] B.C. O'Brien, I.B. Harris, T.J. Beckman, D.A. Reed, D.A. Cook, Standards for reporting qualitative research, Acad. Med. 89 (9) (2014) 1245–1251, https://doi.org/10.1097/acm.0000000000000388.