

Current Trends in Sport Climbing Injuries after the Inclusion into the Olympic Program. Analysis of 633 Injuries within the years 2017/18

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SUMMARY

Objective. To prospectively evaluate current demographics, distribution and severity of rock climbing-related injuries after the sport's inclusion into the Olympic program and to analyze changes in comparison to two prior study populations.

Methods. In 2017-2018, we performed a single-center injury survey including 436 climbing patients with a total number of 633 independent climbing-related injuries or complaints.

Results. 77.1% of the injuries affected the upper extremities, 17.7% the lower and 5.2% other body regions. Injury severity was overall low (Union Internationale des Associations d'Alpinisme (UIAA) metric scale: 1.8 ± 1 (1-4)). The most frequent injuries were finger pulley injuries (12.3%) and finger tenosynovitis (10.6%). 43.9% of reported injuries were acute and 56.1% were chronic. Bouldering accidents were the leading cause of acute injuries (60.4%). Among shoulder injuries, superior labral lesion tears from anterior to posterior (SLAP) represented the leading diagnosis (29.8%). In comparison to our two prior study populations (1998-2001 and 2009-2012), we found: 1) an overall decrease in upper extremity injuries, 2) an increase of lower extremity injuries, 3) a constant decrease of finger pulley injuries and epicondylitis, 4) a rise of knee injuries and shoulder dislocations, 5) an increase of adolescents finger growth plate injuries.

Conclusions. Severity of climbing injuries is low overall. Distinct trends are noticeable: being that some injury rates rose while others fell, preventative strategies only seem partially effective. Therefore, adjustment of preventive strategies is required.

KEY WORDS

Olympia; bouldering; speed; lead; injury surveillance

INTRODUCTION

Rock climbing experienced a rapid increase in popularity over the last few years and will be presented as a new Olympic discipline during the Olympic Games in Tokyo 2020 (1). With the introduction of modern climbing styles and the inclusion of climbing into the Olympic program, the sport has experienced massive changes in terms of professionalization, public attention, and number of sports enthusiasts. While several studies on injury demographics and severity have been published, recently, several studies reported injury mechanisms and specifications which have been rarely seen in the past-indicating a change in injury demograph-

ics, distribution and severity (10-12). Various authors attribute the rise in new climbing injury patterns and change in injury distribution to modern steep and three-dimensional wall architecture, trends in route setting, and the wave of untrained beginners within the sport (1, 2, 12).

Moreover, we recently argued that recent demographic changes in climbing participation have brought up sport specific injury patterns (e.g. knee injuries) that were rarely seen in the past (1, 2). Until today, studies have shown, that overuse injuries in climbing mainly affect the upper extremity, whereas, acute trauma predominantly occurs at the lower extremity (3-8). There are many different subdis-

ciplines in rock climbing (e.g. Bouldering, Alpine-, Speed Climbing); the new trend is to enjoy the easy availability of indoor climbing and bouldering gyms (2). Various studies analyzing injury severity of different climbing subdisciplines have indicated a low injury rate in those two subdisciplines of rock climbing (9).

The assessment of current trends and distributions of injuries can emphasize further preventive strategies and allow a continued assessment of the previous preventive measures. To evaluate current demographics, distribution, and severity of rock climbing related injuries since its inclusion into the Olympic program, we conducted a clinical follow-up study, allowing direct comparison to two prior study populations (14, 15).

METHODS

From January 1st, 2017 to December 31st, 2018, all patients that presented at our clinic complaining of acute or overuse injuries caused by rock climbing and/or bouldering were assessed (**table I**). The study was approved by the institutional review board and all patients provided informed consent. Athletes were seen and treated in our specialized out-patient sports medicine clinic which is a referral center for climbing related injuries (e.g. German Alpine Club). Diagnoses were made based on clinical investigation and radiological findings by three experienced orthopedic surgeons (MS, CL, VS) in the field of climbing-related injuries. All final diagnoses were reviewed and confirmed by

Table I. Patient injury distribution and grading 2017-2018 compared with two prior studies (14,15).

Patients	2017-2018 (n = 436)	2009-2012 (n = 836)	1998-2001 (n = 604)
Number of injuries	633	911	604
Age, years	30.8 ± 11.2 (8-67)	34.1 ± 11.1 (11-77)	28.3 ± 12.4 (13-52)
Sex (men-women)	299-137	630-206	
Climbing level (UIAA metric)	8.6 ± 1.2 (4.3-12)	8.8 ± 1.2 (5.0-11.3)	8.6 ± 1.1 (5.3-11.0)
Bouldering level (V-scale)	5.7 ± 4.0 (0-15)	-	-
Climbing years	9.7 ± 9.2 (0-47)	13.3 ± 10.1 (0.3-64)	7.3 ± 5.8 (2-35)
Climbing hours/week	9.6 ± 5.8 (0.2-35)	-	-
Height (cm)	175 ± 9.5 (130-197)	-	-
Weight (kg)	67.5 ± 11.7 (28-102)	-	-
Body mass index	21.9 ± 2.4 (15.2-34.9)	-	-
Women	20.6 ± 2.3 (15.9-31.8)	-	-
Men	22.4 ± 2.3 (15.2-34.9)	-	-
Injury distribution			
Upper extremity	488 (77.1)	833 (91.4)	405 (67.1)
Lower extremity	112 (17.7)	58 (6.4)	77 (12.7)
Other	33 (5.2)	20 (2.2)	122 (20.2)
Injury grading			
UIAA 1	131 (20.1)	17 (1.9)	4 (0.6)
UIAA 2	461 (72.1)	881 (96.7)	584 (96.7)
UIAA 3	40 (6.3)	13 (1.4)	9 (1.5)
UIAA 4	1 (0.1)	None	7 (1.2)
UIAA 5-6	None	None	None
Injury type			
Acute	278 (43.9)	380 (41.7)	308 (51)
Overuse injuries	355 (56.1)	531 (58.3)	296 (49)
Cause of acute injury			
Bouldering	168 (60.4)		
Rock climbing	88 (31.7)	“mostly”	
Other	22 (7.9)		

the senior author (VS). Patients with acute injuries initially seen and treated in the emergency department of our 24-hour, level 1 trauma center were later re-examined in the out-patients sports medicine clinic. The clinic is one of three trauma centers of Germany's biggest outdoor sport-climbing and bouldering areas, the Frankenjura. A standard questionnaire, which included questions about medical history, and a physical examination protocol were conducted on all patients. Only patients suffering from pain during or after climbing were included in the study. Injuries caused by rock climbing or bouldering activities were defined as medical conditions forcing the athlete to rest from his/her sport due to pain or dysfunction and the necessity to seek help from a physician. While acute injuries were defined as injuries with a sudden onset during climbing without any prior history of complaints, overuse injuries were defined as chronic injuries without a singular causing event or a specific trauma that had developed during or after climbing. The Union Internationale des Associations d'Alpinisme (UIAA) metric scale was used for evaluation of climbing levels as in two previous studies from our center (years 1998-2001: 604 climbing injuries; and 2009-2012: 911 climbing injuries) (14, 15). Injuries were graded according to the UIAA injury score. The orchard sports injury classification system 10 (OSICS 10) scale was used to categorize the injury distribution following the Union Internationale des Associations d'Alpinisme (UIAA) MedCom recommendation (13, 16). Microsoft Excel (Microsoft, Redmond, Washington, USA) was used for data collection; statistical analyses were performed using SigmaStat software (Systat Software Inc., San Jose, USA). Values were checked for normality with the Shapiro-Wilk test. To determine the difference between the groups, a t-test or rank-sum test was used depending on normal distribution. P-values < 0.05 were considered as statistically significant.

RESULTS

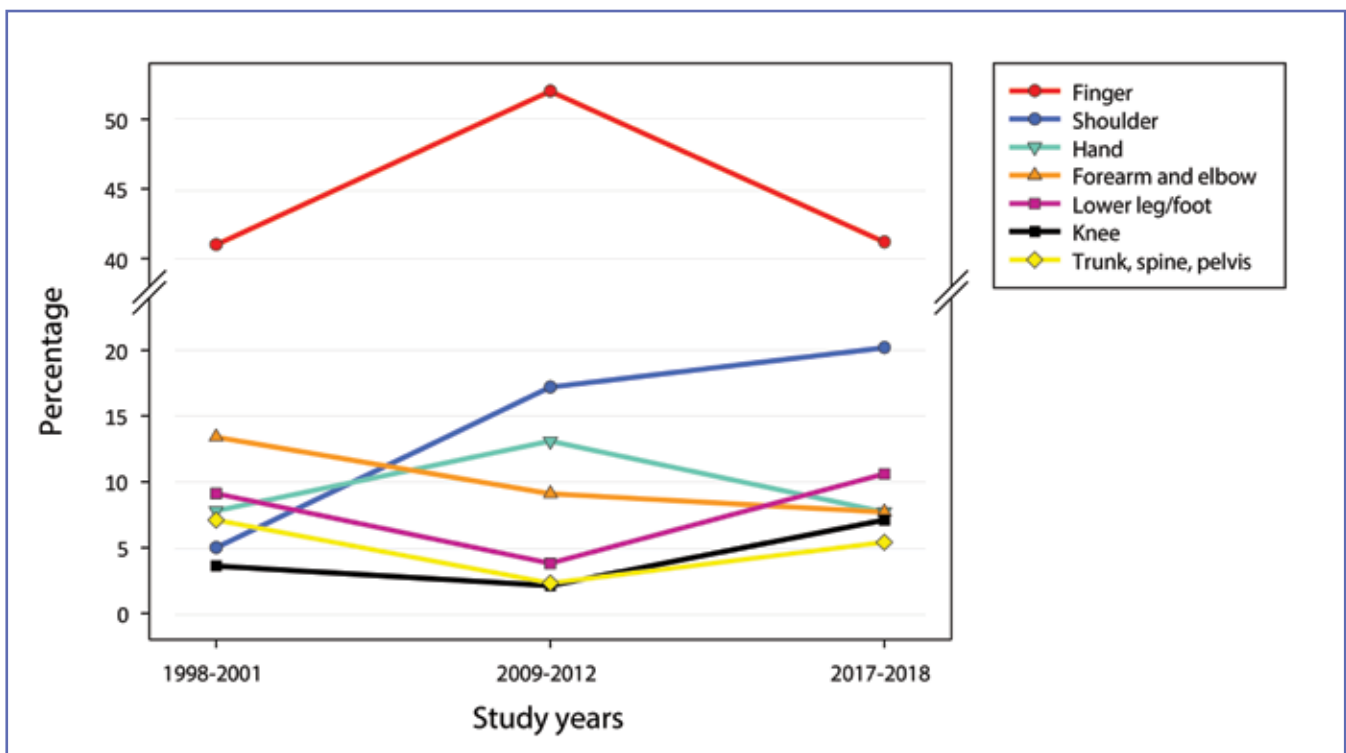
In 2017 and 2018, 436 patients were treated with 633 independent injuries caused by rock climbing or bouldering (**table I**). Of the 436 patients, 197 patients had two injuries within the study period. Among the 633 injuries, 355 (56.1%) were overuse injuries and 278 (43.9%) were acute injuries. The acute injury mechanism rates were bouldering (60.4%), rock climbing (31.7%) and other (e.g. hangboard training, 7.9%) (**table I**). The upper extremity was affected in 77.1%, the lower extremity in 17.7% and the head, neck and trunk in 5.2% of all cases. For detailed information on injury distribution, see **tables I-III** and **figure 1**. The mean climbing level (UIAA 8.6 ± 1.2 (4.3-

12)) was constant as compared to the two prior study populations (1998-2001: mean UIAA grade 8.6; 2009-2012: mean UIAA grade 8.8) (**table I**). Localizations of injuries following the OSICS 10 score are presented in **table III** (13). **Table IV** provides a comparison of the injury distribution (ten most frequent injuries), as previously published (**table IV, figure 2**). Finger injuries represented 41.2% of all injuries and shoulder injuries accounted for 20.2%. Hand injuries (7.7%), forearm/elbow pathologies (7.7%) and lower leg/foot injuries (10.6%) were diagnosed less often (**table II, figure 1**). Finger pulley injuries represented 12.3% of all injuries and accounted for 29.9% of all finger injuries. This diagnosis was the most frequently seen injury in the study group, followed by finger tenosynovitis (10.6%), and finger joint capsulitis (7.7%) (**Table 4**). Overall, 17 different diagnoses of finger injuries were present (**table V, figure 3**). Among shoulder injuries, SLAP tears were found most frequently (29.8%), followed by subacromial impingement syndromes (27.4%) and dislocations/Bankart lesions (17.7%) (**table VI**). The average UIAA injury score was 1.8 ± 1 (1-4). None of the athletes suffered a UIAA grade 5 injury and none of them died (UIAA 6) (**Table 1**). Climbing level (UIAA level, $p=0.006$) and climbing experience (climbing years, $p=0.029$) were both significantly higher in men than in women. The difference in climbing levels was lower than in prior studies; mean female UIAA level was 8.33 and mean male UIAA level was 8.73, respectively. Climbing levels showed a wider range than in the past, meaning that there was an increased number of both beginner athletes and world-class athletes within the study population (**table I**).

In comparison with the two prior study periods, the main findings were: the upper extremity was less affected in the presented study population, whereas, lower extremity injuries were diagnosed more frequently (14, 15) (**tables I-III**). Finger pulley injuries consistently decreased from 20.2% (1998-2001) and 15.4% (2009-2012) to 12.3% in the current analysis (**table IV**). Similar findings were seen for epicondylitis, which currently represented only 3.3% (1998-2001: 8.4%, 2009-2012: 5.5%). Knee injuries, wrist strains and epiphyseal fractures of the finger were found to be among the ten most frequently diagnosed injuries, whereas, they were not seen frequently within the two prior studies (**table IV**). Epiphyseal fractures, which were seen in 0.8% of all cases between 1998-2001 and 3.4% from 2009-2012, were present in 7.3% of all finger injuries within our athletes (**tables IV and V**). Among the shoulder pathologies, we found a rise of shoulder dislocations (2009-2012: 10.2%, 2017-2018: 17.7%) and acromioclavicular joint injuries (2009-2012: 1.9%, 2017-2018: 9.7%) (**table VI**).

Table II. Injury distribution according to body area as presented previously (data of trunk, spine and pelvis merged). Values are n (%).

Body area	2017-2018 (n = 633)	2009-2012 (n = 911)	1998-2001 (n=604)
Finger	261 (41.2)	474 (52)	247 (41)
Shoulder	128 (20.2)	157 (17.2)	30 (5)
Hand	49 (7.7)	119 (13.1)	47 (7.8)
Forearm and elbow	49 (7.7)	83 (9.1)	81 (13.4)
Lower leg/foot	67 (10.6)	35 (3.8)	55 (9.1)
Knee	45 (7.1)	19 (2.1)	22 (3.6)
Trunk, spine, pelvis	34 (5.4)	21 (2.3)	43 (7.1)
Other	-	3 (0.3)	-

**Figure 1.** Injury distribution according to body area compared with two prior studies.

DISCUSSION

This study focuses on current trends and changes in rock climbing related injuries since its inclusion into the Olympic program for Tokyo 2020 (1). Two prior studies have been conducted with the same methods, allowing a direct comparison and interpretation of data (14, 15). The gap between the two first studies was 10 years, and 7 years have passed since the last (2009-2012). However, the world-

wide rise of bouldering within the last 7-8 years, and the inclusion into the Olympics, has changed the sport rapidly (12, 17). On one hand, more and more athletes around the world are enthusiastic about rock climbing and bouldering, and on the other, the sport also professionalises rapidly (1). Our study population nicely represents both the changes, as more beginners and world-class athletes were among the patients than in our prior studies. Mean climbing levels were

Table III. Anatomical sites according to Orchard Sports Injury Classification System 10 (OSICS). Values are n (%). (Data 1998-2001 n.A.).

Main grouping	Category	OSICS Designation	2017-2018 (n = 633)	2009-2012 (n = 911)
Head and neck	Head/face	H	1 (0.2)	0 (0)
	Neck/cervical spine	N	3 (0.5)	4 (0.4)
Upper limbs	Shoulder/clavicle	S	115 (18.2)	157 (17.2)
	Upper arm	U	14 (2.2)	0 (0)
	Elbow	E	39 (6.2)	70 (7.7)
	Forearm	R	10 (1.6)	12 (1.3)
	Wrist	W	32 (5.1)	69 (7.6)
	Hand/finger/thumb	P	276 (43.6)	528 (57.1)
Trunk	Chest (sternum/ribs)	C	2 (0.3)	0 (0)
	Thoracic spine	D	5 (0.8)	0 (0)
	Trunk, abdomen	O	2 (0.3)	0 (0)
	Lumbar spine	B	9 (1.4)	11 (1.2)
	Pelvis and buttock	L	7 (1.1)	2 (0.2)
Lower limbs	Hip/groin	G	5 (0.8)	4 (0.4)
	Thigh	T	6 (0.9)	0 (0)
	Knee	K	45 (7.1)	19 (2.1)
	Lower leg	Q	7 (1.1)	3 (0.3)
	Ankle	A	39 (6.2)	12 (1.3)
	Foot/toe	F	15 (2.4)	20 (2.2)
Location unspecified		X	1 (0.2)	0 (0)

Table IV. Distribution of diagnoses (ten most frequent injuries).

Injuries 2017-2018 (n = 633)	n	%	Injuries 2009-2012 (n = 911)	n	%	Injuries 1998-2001 (n = 604)	n	%
Pulley injury (finger)	78	12,3	Pulley injury (finger)	140	15,4	Pulley injury (finger)	122	20,2
Tenosynovitis (finger)	67	10,6	Capsulitis (finger)	87	9,5	Epicondylitis	51	8,4
Capsulitis (finger)	49	7,7	Tenosynovitis (finger)	80	8,8	Tenosynovitis (finger)	42	7,0
Knee injury	45	7,1	SLAP tear	51	5,6	Strain finger joint capsule	37	6,1
SLAP tear (shoulder)	37	5,8	Epicondylitis	50	5,5	Skin abrasions	34	5,6
Impingement (shoulder)	34	5,4	Impingement (shoulder)	40	4,4	Back problems	24	4,0
Wrist strain	22	3,5	Strain finger flexor tendon	36	4,0	Knee injuries	14	2,3
Epicondylitis	21	3,3	Dupuytren disease	30	3,3	Fractures	14	2,3
Growth plate injuries (finger)	19	3,0	Strain finger joint capsule	25	2,7	Capsulitis (finger)	13	2,2
Spinal injuries	18	2,8	Ganglion finger flexor tendon	19	2,1	Ganglion finger flexor tendon	11	1,8

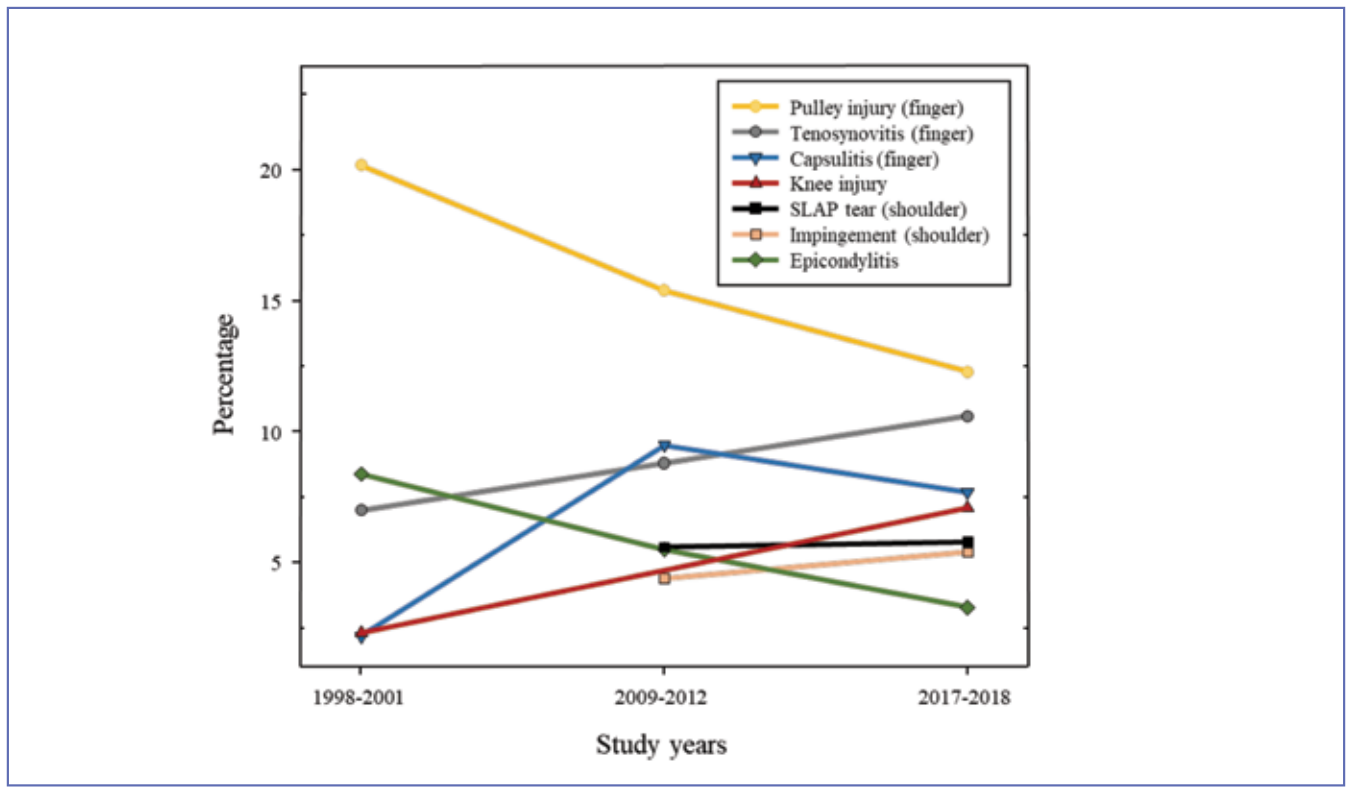


Figure 2. Development of most frequent injuries over the three different survey periods.

Table V. Most frequent finger injuries 2017-2018 (n=261), 2009-2012 (n=474) and 1998-2001 (247).

Finger injuries 2017-2018 (n=261)	n	%	Finger injuries 2009-2012 (n=474)	n	%	Finger injuries 1998-2001 (n=247)	n	%
Pulley injury	78	29.9	Pulley injury	140	29.5	Pulley injury	122	49.4
Tenosynovitis flexor tendon	67	25.7	Capsulitis	87	18.4	Tenosynovitis	42	17.0
Capsulitis	49	18.8	Tenosynovitis flexor tendon	80	16.9	Strain finger joint capsule	37	15.0
Epiphyseal fracture	19	7.3	Strain flexor tendon	36	7.6	Capsulitis	13	5.3
Lumbrical tear/strain	12	4.6	Strain finger joint capsule	25	5.3	Ganglion	11	4.5
Strain finger joint capsule	10	3.8	Ganglion finger flexor tendon	19	4.0	Strain flexor tendon	7	2.8
Osteoarthritis	5	1.9	Lumbrical shift syndrome	19	4.0	Fracture	7	2.8
Strain flexor tendon	4	1.5	Collateral ligament injury	17	3.6	Osteoarthritis	7	2.8
Ganglion finger flexor tendon	3	1.2	Epiphyseal fracture	16	3.4	Soft tissue injury	5	2.0
Contusion	3	1.2	Osteoarthritis	14	3.0	Tendon rupture	4	1.6
Phlegmonia/cellulitis	2	0.7	Extensor hood syndrome	7	1.5	Collateral ligament injury	3	1.2
Collateral ligament injury	2	0.7	Lumbrical tear/strain	4	0.8	Osseous tear fibrocartilago palmaris	2	0.8
Distorsion thumb	1	0.3	Snap finger	3	0.6	Epiphyseal fracture	2	0.8

Table V. Continues

Finger injuries 2017-2018 (n=261)	n	%	Finger injuries 2009-2012 (n=474)	n	%	Finger injuries 1998-2001 (n=247)	n	%
Disruption volar plate	1	0.3	Cartilage injury	2	0.4	Lumbrical tear/strain	2	0.8
Cartilage injury	1	0.3	Flip phenomena	2	0.4	Phlegmonia/cellulitis	1	0.4
Neuropraxia	1	0.3	Broken osteophyte	1	0.2	Finger amputation	1	0.4
PIP joint dislocation	1	0.3	Avulsion fracture	1	0.2	-	-	-
Snap finger	1	0.3	Flexor contraction	1	0.2	-	-	-
Contracture finger flexor tendon	1	0.3	Rupture connexus intertend.	1	0.2	-	-	-
-	-	-	Enchondroma	1	0.2	-	-	-
-	-	-	Contusion	1	0.2	-	-	-
-	-	-	Tendon rupture	1	0.2	-	-	-

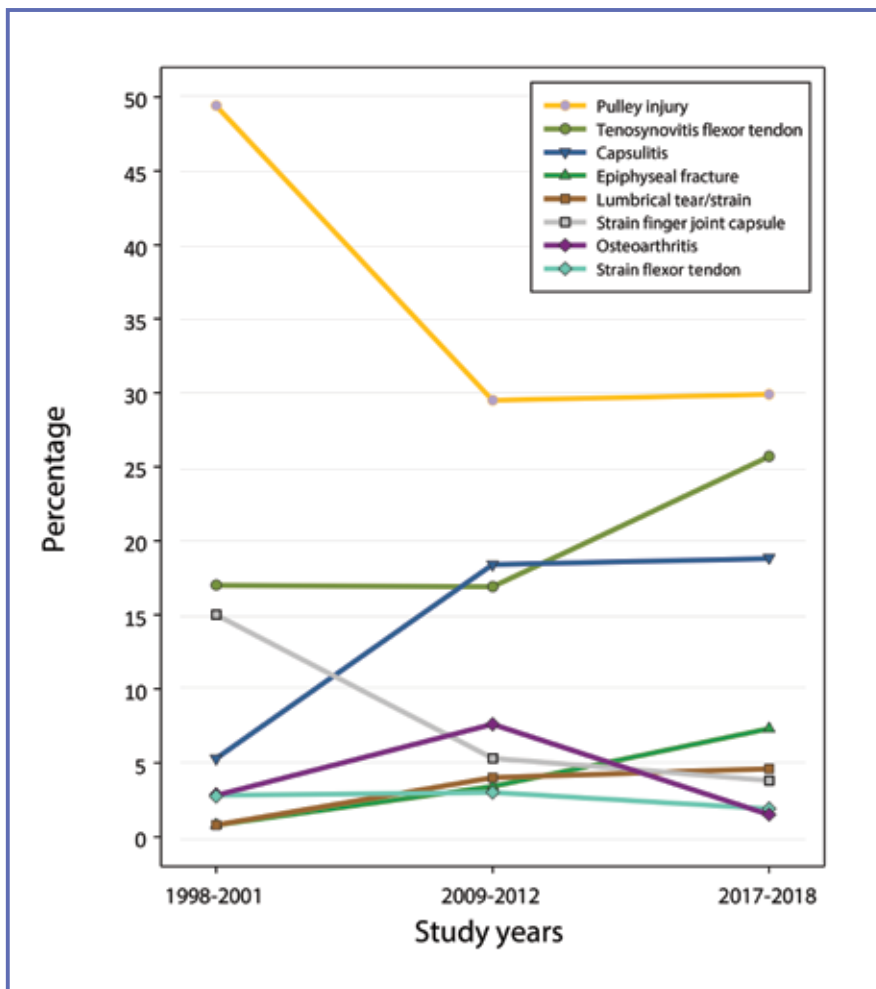


Figure 3. Development of most frequent finger injuries over the three different survey periods.

consistent among our three study periods, but a vast scatter over the entire UIAA climbing level scale currently highlights a wide study population. UIAA level one represents the easiest possible climb and UIAA level 12 the world's hardest climbs. Both are represented in the study group.

While most of our patients predominantly climb within the local climbing areas and gyms, several athletes from other regions sought our advice as a second opinion after injuring themselves climbing in other areas. This is consistent with the two prior studies (14, 15). The fact that the mean difference in climbing levels among genders was lower than other studies might be explained by the higher percentage of beginners within the current analysis. Male athletes, in general, might have a slightly higher climbing performance potential than female, but gender specific differences are seen less in beginners (3, 5, 12, 18-22). Our data does not allow answering the question whether or not men or female are more risk prone. Self-efficacy and sex differences (higher in males) emerged as important predictors of risk in rock climbing in a psychological analysis (23) and Neuhof et al. (2011) (24) found a higher injury rate (number of

Table VIII. Distribution of shoulder injuries.

Shoulder Injuries 2017-2018 (n = 154)			Shoulder Injuries 2009-2012 (n = 157)		
	n	%		n	%
SLAP	37	29.8	SLAP	51	32.5
Impingement	34	27.4	Impingement	40	25.5
Dislocation. bankart lesion	22	17.7	Shoulder sprain	17	10.8
Shoulder sprain	16	12.9	Dislocation. bankart lesion	16	10.2
Rotator cuff tear	12	9.7	Supraspinatus tendonitis	7	4.5
Acromioclavicular joint injury	12	9.7	Instability (non-bankart)	7	4.5
Tendinosis of long biceps tendon	6	4.8	Tendinosis of long biceps tendon	5	3.2
Instability (non-bankart)	5	4.0	Rupture of long biceps tendon	5	3.2
Pulley injury	5	4.0	Rotator cuff tear	5	3.2
Rupture of long biceps tendon	2	1.6	Acromioclavicular joint injury	3	1.9
Other	2	1.6	Pulley injury	1	0.6
Supraspinatus tendonitis	1	0.8			

injuries divided through 1000 hours of sport participation) for female (0.23) than for male (0.19) climbers ($p=0.83$). In contrast, Josephsen et al. (25) found no relation of bouldering injuries to gender, years of climbing, body mass index or weight.

While an overall low injury rate has been described for bouldering in the past (4, 25-29), the vast majority of acute injuries in our athletes was found to result from this sub-discipline (30). This fact might be explained by the new wave of beginners that perform indoor bouldering and who were described to be prone to get injured more frequently (2, 31). Considering acutely injured athletes generally seek help at the closest medical facility rather than a facility specialized in climbing injuries (15), it must be assumed that acute injuries in both bouldering and rock climbing are underrepresented in our study. This is especially true in cases of fractures or acute ligament injuries. Injuries that are known to result from ground falls during bouldering, rather than from rope protected climbing, are knee injuries and dislocations of the shoulder (both glenohumeral and acromio-clavicular joints). The percentage of knee injuries increased from 2.3% (1998-2001) to 7.1% (current study group) while glenohumeral shoulder dislocations and acromioclavicular joint injuries increased from 10.2% and 1.9% (2009-2012) to 17.7% and 9.7%, respectively (**tables IV, VI**). There could be a slight sample bias, as the authors specialize in sports medicine upper extremity and knee surgery. However, the findings coincide with other recently published studies (12, 17). In addition, that sample bias already existed in prior studies, and would therefore not influence a comparison to these data.

The introduction of several preventive strategies (e.g. increase in climber's and coach's awareness on warm up strategies, antagonist training and neglect of certain training strategies, such as pull-ups with uniform hand positioning routines or finger taping) have been established to increase awareness and reduce prevalence of various injury types. Ever since, physical complaints such as pulley injuries and epicondylitis ("climbers' elbow") have decreasingly been detected/diagnosed (14, 15). Various associations, such as the British Mountaineering Council (BMC), support and actively promote prevention programs (<https://www.thebmc.co.uk/growth-plate-stress-fractures-in-teenage-climbers>). Unfortunately, preventive measures have not yet caused a decrease of epiphyseal injuries in adolescent athletes in our current population (15, 32, 33). Since the first study (1998-2001) a sevenfold increase of this injury type has been observed (14, 15) (**table V**). This increase can partially be explained by the rising numbers of adolescent athletes that goes along with the world-wide climbing and bouldering hype. However, a positive finding among the affected athletes was that none of the 19 patients reported having trained on a campus board training tool, which is known to strongly favor the development of epiphyseal injuries of the finger and showed significance for early osteoarthritis in young climbers (15). The numbers, however, are still alarming and need to be further acknowledged by the national and international climbing community. Precautions need to be implemented and early detection needs to be increased. Even if it may seem as previous work on prophylaxis and knowledge transfer may not have influenced this specific epidemiology, we predominantly see

these injuries at an earlier, and thus better, treatable stage. Hopefully, increased public awareness will give better treatment options and lead to better outcomes in the future. In this respect, we perform ultrasound scans in young climbers of national, state, and regional teams during our yearly examination (18). During these exams, we evaluate the most vulnerable phase for growth plate fractures, known to be the period just before dorsal closure of the growth plates during their peak growth spurt (34). Climbers and parents are informed about the increased risk and advised to seek immediate consultation in the case of dorsal sided finger pain after climbing that continues for more than one week (35). To avoid epiphyseal stress reactions, load management and recovery must be encouraged, particularly in young athletes which are strongly motivated to incessantly train and climb. It is important to better reach adolescent athletes and their parents, especially those without trainers, to draw attention to the dangers and symptoms growth plate injuries, and to inform them of preventative measures. This is something that even the operators of commercial gyms should be aware of and responsible for. Our study has some important limitations. The cohort of climbers in this study is diverse, as most of the athletes came from local sport climbing areas or gyms, others came from further away. The kind of climbing predominantly performed in the area may influence the injury profile. This bias is constant throughout all our studies, though (14, 15). The previous studies did not report on specific details about the injury cause, such as the exact climbing activ-

ity (sub-discipline). Therefore, a detailed comparison on injury frequencies among subdisciplines was not possible. A selection bias cannot be dismissed; as we are very active in treating finger, shoulder and knee injuries in climbers, the patient selection is certainly affected. Nevertheless, this bias is also existing in the previous analysis (36, 37). Thus, constant re-evaluation is important to show trends in injury development and the effects of preventive measures in this context, the implementation of preventive strategies or training programs should be individually assessed.

CONCLUSIONS

The analysis of our recently-treated rock-climbing patients revealed several important findings. Overall, low injury severity in rock climbing and bouldering could be confirmed. Bouldering caused more acute injuries than rope-protected climbing. While common rock climbing related diagnosis, such as finger pulley injuries or epicondylitis decreased in frequency, other complaints (e.g. knee injuries) increased significantly. Despite all efforts, epiphyseal finger injuries in young climbers increased further. Therefore, more educational efforts and specific training are necessary to assure an early detection and treatment, thus avoiding long-term consequences.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests (38).

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