A special danger in bowling and skittle – bowling ball induced injuries of the distal fingers

Bundeskegelbahn oder Bowling-Center? Ein spezieller Unfallmechanismus bei den Präzisionssportarten Bowling und Kegeln

Abstract

Purpose: Injuries to the hand and fingers have been reported related to the popular sports of bowling and skittle. Both sports differ regarding size, shape, weight of the ball and technique. The focus of this study is to address whether bowling or skittle players are more prone to injuries.

Methods: We assessed hand injuries related to bowling or skittle in a retrospective analysis of patients treated in our department between 2006 and 2016. We also investigated differences between both sports with regards to patient demographics, type and location of lesion, and treatment.

Results: A total of 13 patients were identified with minors comprising a total of number of six patients. Six from the overall cohort developed injuries related to bowling, and seven sustained injuries related to skittle. In all cases, the pattern of injury revealed a contusion between two balls during retrieval. The distal phalanx was affected in all patients, and the middle phalanx in one. Out of the 13 patients, one patient presented with lesions on the 3rd finger, ten patients on the 4th finger and two patients on the 5th finger. In cases of bone injury (n=10), patients received surgical treatment via K-wire-fixation (n=2), suture-cerclage (n=1), resection of little distal fragments (n=1) or splinting only (n=6). There were no significant differences between patients with bowling or skittle injuries with regard to frequency, type and location of the lesions.

Conclusion: Bowling and skittle are comparable with their inherent risk of distal finger trauma. Almost all cases required surgical intervention. As most injuries occurred during retrieval of the ball from the rack, efforts should be put on prevention at this point. In both sports the majority of patients were minor, so age restriction should be evaluated.

Level of evidence: Therapeutic study, level IV

Keywords: bowling injuries, skittle injuries, sport injuries

Sören Könneker1
Nicco Krezdorn1
Helga Henseler1
Christian von Falck2
Christine Radtke3
Peter M. Vogt1

1 Department of Plastic, Aesthetic, Hand and Reconstructive Surgery, Hannover Medical School, Hannover, Germany
2 Department of Diagnostic and Interventional Radiology, Hannover Medical School, Hannover, Germany
3 Department of Plastic and Reconstructive Surgery, Medical University of Vienna, Vienna, Austria

Zusammenfassung


Ergebnisse: In 13 Fällen wurden Handverletzungen durch Bowling oder Kegeln chirurgisch behandelt, wovon sechs minderjährige Kinder waren.


Evidenzlevel: Therapeutische Studie, Stufe IV

Schlüsselwörter: Bowling-Verletzung, Kegelverletzung, Sportverletzung

Introduction

Bowling and skittle are very popular recreational activities in Western countries and have been around since ancient Egypt [1]. In the US alone, over 50,000,000 people per year enjoy occasional bowling [2]. Skittle – the predecessor of bowling – is more popular in Europe. In both sports, the player attempts to hit a set of pins with a ball, though both sports differ in regards to the number of pins, size of the alley as well as size and design of the balls.

As with every other sport, bowling and skittle can also lead to injuries. The range of medical problems related to both sports is rather broad. A retrospective analysis in 2011 by Kerr et al. revealed over 375,000 bowling related injuries in the United States, affecting fingers, trunk, feet, and ankles [3]. Despite the large number of cases, the authors lament a lack of sufficient information on the circumstances of the injury to derive specific preventive recommendations.

Injuries to the upper extremity comprise of a variety of forms and can be related to traumatic events or repetitive and long-term practice of the sport.

Based on the different weight and design of the balls in bowling (three finger holes) and skittle (no holes) we were hypothesizing different traumatic presentations and subsequently different treatment among the patients in our cohort.

Material and methods

The department of Plastic, Aesthetic, Hand and Reconstructive Surgery is the statewide trauma centre and university hospital. We used the hospital information system (HIS) to retrospectively analyse all patients with hand injuries that have been treated in our department from 2006 to 2016. We utilized diagnoses and procedure codes to identify patients with finger or hand injuries in combination with key words related to bowling or skittle injury. We only included patients that were treated in an institution or outpatient clinic because of bowling or skittle related hand trauma.

Patient history as well as surgery notes (if available) were analyzed to assess demographics as well as details of the injury and treatment. All patients received an x-ray at time of admission. Fractures were classified according to Green’s classification [4]; distal fractures of the phalanx are classified into three types: tuft fractures, shaft fractures, and intraarticular fractures.

Patients with bone fractures received surgical treatment either under general or regional anaesthesia. Depending on the presentation of the fracture, these were fixed with K-wires, suture cerclage or splinted. When the nail or nail bed was injured, the nail was removed, trepanated and replaced if possible after repair of the nail bed. In selected cases, artificial nail splints were used, when the original nail was too damaged or lost. All wounds were washed and damaged tissue was removed to allow for optimal wound healing. The affected fingers were immobilized in splints or casts and any osteosynthesis material was removed after 7 weeks if a new x-ray control showed sufficient bone healing.

Data was de-identified, collected, and analysed in Microsoft Excel (Microsoft, Redmond, WA, USA) for calculation of descriptives and means and Graphpad Prism 6 (Graphpad Software Inc., USA) was used for graphing. Statistical analysis was performed using an independent student t-test.

This retrospective study was approved by the ethics committee of Hannover Medical School (No. 3453-2016).
Results

A total of 13 patients, who had received treatment in our centre because of bowling or skittle related injuries of the hand, was identified. Of these, 7 were treated because of injuries related to skittle balls and 6 related to bowling balls. Overall mean age was 26 years (±22 years), with no significant differences between skittle (28y ±24) and bowling (23y ±20). 46.1% (n=6) of the patients were minors aged 14 years or younger, with both three patients in the bowling and skittle group. There were more men affected overall (8 male, 5 female), with more men for skittle (5 male, 2 female) and equal distribution in bowling (3 male, 3 female) injuries (s. Table 1).

Table 1: Demographic characteristics of patient cohort with distribution of age and sex

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Skittle</th>
<th>Bowling</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>13</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Mean age</td>
<td>26</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>Minor*</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Female</td>
<td>5</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

* Minors are defined as 14 years old or younger.

The pattern of injury was always a contusion between two balls when the ball was retrieved from the rack and the respective finger was crushed between two balls. In 10 cases (76.9%), the injury occurred on the 4th finger, of which four were located on the right hand and six on the left hand. One patient showed a skittle related injury on the left 3rd finger. In the remaining two patients with bowling injury, the lesion was located on the 5th finger of the right hand (Figure 1).

Eleven out of the thirteen patients presented with an open wound soft tissue injury and one patient with a contusion with hematoma (Figure 2). Nine patients were treated inhouse with a mean length of hospital stay of two days and four patients were treated ambulatory. We found injuries of the nail and/or nail bed in 69.2% (n=9) of the patients. X-rays confirmed bone fractures in 10 patients (76.9%), of which six showed a third degree open fracture. In seven of ten cases with fractures, the bone fractures were classified as tuft fractures (70%), in two cases (20%) as shaft fractures of the distal phalanx, and in one case (10%) as comminuted fracture of the distal and middle phalanx (Figure 3). In seven of ten cases with fractures, the fracture line was presented longitudinally with involving the DIP joint in two of these cases (Figure 4). There were no significant differences between these lesions in patients with either skittle or bowling injuries (Figure 3).

Two patients with bony fractures were treated with K-wire fixation (patient 1, 2) which was removed after seven weeks (Figure 4).

Discussion

Injuries of the hand related to bowling and skittle tend to be focused on the 4th and secondary on the 5th finger and are relatively severe. The majority of the patients (77%) experienced bony lesions and all patients required surgical treatment. Frequency, demographic distribution, and severity of injuries were comparable between bowling and skittle, with exception of a higher rate of skittle injuries in males. With regard to the mechanism of trauma, the injury seems to occur when the bowling/skittle ball is retrieved from the dispenser in all cases, both in bowling and skittle. When a new ball is loaded on to the dispenser all present balls get moved quite forcefully to accommodate the new ball. If there is a lack of attention, the fingers not primarily grabbing the ball – i.e. fingers 4 and 5 – can get bruised between two moving balls and create the injury described in this paper. Nearly half of our patients were minors, which raises the question of proper training, instruction and supervision during the game as well as safety concerns of the bowling ball dispensers.

Kerr et al. assessed the epidemiology of bowling related injuries in the US between 1990 and 2008 and showed that finger and fingertips are the most common zone of injury in bowling [3], with soft tissue injury occurring most often. Prior reports mainly focus on injuries that derive from wrong forms of ball release or drop of the ball [3]. The balls used in bowling and skittle differ substantially in size, weight and design. In bowling the ball is bigger and has three holes to accommodate the fingers 1, 3, and 4 or 1, 2, and 3 to grab the ball while swinging. Skittle balls on the other hand are smaller and lighter and don’t have any holes. They are held in the palm of the hand while swinging. Based on available data, we therefore initially suspected that injuries to the hand related to
Figure 2: Bowling or skittle injuries on the hand, especially on 4th and 5th finger. (A) Tuft fracture of the distal phalanx with nail bed involvement. (B) Splint of nail bed with artificial nail after nail bed repair. (C) Contusion of 4th finger with avulsion of the nail bed but no bone fracture. (D) Palmar and dorsal contusion of 4th finger after surgical treatment.

Figure 3: Frequency of lesions of the affected fingers with (A) nail-bed related injuries and (B) classification of fractures if present. There were no statistically significant differences.

Figure 4: X-rays of bony lesions after bowling and skittle injuries. Comminuted fracture of the distal and middle phalanx of the 4th finger at time of admission (A) and after surgical treatment with multiple K-wires (B). Distal tuft fracture at time of admission (C) and in 2 planes after treatment (D, E) as well as 7 weeks later after K-wire has been removed (F).
Figure 5: Trauma related to fingers stuck in a bowling ball during release is likely a result from vertical forces with a combining bending moment, giving nature to fracture lines as depicted in (A). Postulated mechanism of injury in our patient cohort shown in (B). When picking the ball from the rack, the finger gets crushed between two balls. The horizontally moving forces lead to the horizontal fracture line encountered in our patients.

those two sports would differ, likely through the mechanism of trauma. In cases of transverse fractures, an accompanying bending moment is assumed in the trauma mechanism [5] as would be the case with fingers in the hole of a bowling ball (s. Figure 5). The x-ray results of our patients showed different severe fractures of the distal phalanx and in one case the middle phalanx. In seven of nine patients with fractures of the distal phalanx the fracture line presented longitudinally as sign of strictly anterior-posterior force of bruise trauma. Most likely, this is caused by the crushing mechanism of the fingers between two balls without accompanying bending moment (Figure 5). There is only limited epidemiologic data on pinching/bruising from ball retrieval; in Kerr’s study 8.4% of bowling related injuries were bruising or smashing injuries by the ball [3].

In our case series, the longitudinal fracture line reached the DIP joint in a subset of two cases that required an accurate restoration of joint surfaces. We use K-wire fixation to achieve this as has been described (s. Figure 4) [6]. Injuries of the distal phalanx with bony fractures can be complex to restore and can have longterm detrimental effects to form and function [6]. The risk of late diagnosis is especially elevated in children and therefore x-rays should be routinely taken [7].

Other injuries of the fingers described in bowling include stress fractures of the middle phalanx that have been reported in semi-professional bowlers, likely due to overuse [8]. Yet other forms include luxation [9] or palmar fracture of the proximal interphalangeal joint [10]. Traumatic neuroma formation of the digital nerve of the thumb induced by proliferation of fibrotic tissue surrounding the nerve, also known as Bowler’s thumb, has been described as a common disease in amateur bowlers [11], [12], [13]. None of these were present in the patient cohort we identified in our centre that has been treated for bowling or skittle related hand problems.

The major implications of our findings are threefold.

1. Crush/pinch injuries with bowling or skittle balls are severe. Even though numbers of patients are small, the majority of them required surgery and at times even osteosynthesis.

2. Ball dispensers are not safe. Safety could easily be improved through optimized design and engineering ensuring that there is no ball-to-ball contact on the rack and therefore preventing the trauma described here.

3. Children younger than 18 years old are most commonly affected. Proper training and supervision during retrieval of the balls are potential areas of improvement for children, parents, and staff of bowling and skittle centres.
One of the major limitations is the retrospective study design in combination with limited continuous and consistent data. As the incidence of this type of injury is very low, it is though the most appropriate design to gain more understanding of this entity.

Follow-up data is not available, both due to the long time frame of the study as well as the fact that follow-up visits were not necessarily performed within our institution. Therefore, we are not able to draw conclusions with regard to functional and aesthetic long-term outcome. Despite this shortcoming, this study is the first to report on a relatively large cohort of crush induced bowling and skittle injuries of the hand and hopefully adds to better understand and prevent injuries in these two popular sports.

In summary, we can conclude that bowling and skittle show a comparable risk with regard to the location and severity of finger and fingertip lesion as well as a similar demographic distribution of injuries. Children are more prone to experience this type of injury that is usually acquired during retrieval of the ball from the dispenser. Improving the safety of the ball dispensers as well as efforts towards raising awareness and training for children, their caretakers and staff of the bowling alley may help to prevent these injuries in the future.

References


Notes

Authorship

Sören Könneker and Nicco Krezdorn contributed equally.

Conference presentation

Presented in part at the 2016 Annual Meeting of the German Society of Hand Surgery; September 22-24 2016; Frankfurt, Germany [14].

Ethical approval

This retrospective study was approved by the ethics committee of Hannover Medical School (No. 3453-2016).

Competing interests

The authors declare that they have no competing interests.
Corresponding author:
Sören Könneker, MD
Hannover Medical School, Department of Plastic, Aesthetic, Hand and Reconstructive Surgery, Carl-Neuberg-Str. 1, 30625 Hannover, Germany, Phone: +49 511 532 8864, Fax: +49 511 532 8890
koenneker.soeren@mh-hannover.de

Please cite as
DOI: 10.3205/gpras000048, URN: urn:nbn:de:0183-gpras0000486

This article is freely available from http://www.egms.de/en/journals/gpras/2017-7/gpras000048.shtml

Published: 2017-09-29

Copyright
©2017 Könneker et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution 4.0 License. See license information at http://creativecommons.org/licenses/by/4.0/.