KLINIČKO-EPIDEMIOLOŠKA ANALIZA POVREDA ŠAKE I RUČNOG ZGLOBA PROUZROKOVANIH CIRKULAROM, U DOMAĆINSTVU I INDUSTRIJI

ORIGINALNI RAD

ORIGINAL ARTICLE

CLINICAL EPIDEMIOLOGY OF DOMESTIC AND INDUSTRIAL HAND AND WRIST CIRCULAR SAW INJURIES

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SAŽETAK

Uvod: Povrede šake su izuzetno česte. Procenjuje se da se skoro četvrtina svih povreda zbrinutih u hitnoj službi odnosi na šaku, zbog izloženosti šake traumi usled njene funkcije i protektivnog pokreta. Ove povrede se obično sreću kod mlade, radno aktivne populacije, a obuhvataju istovremenu povredu više različitih tkiva.

Cilj: Cilj studije jeste da se ispitaju učestalost i karakteristike povreda šake zadobijenih cirkularom, kao i postojeći faktori rizika, kako bi se uticalo na prevenciju ovih povreda.

Materijal i metode: Studija je retrospektivnog karaktera. Obuhvatila je 365 pacijenata, u periodu od pet godina, koji su zadobili povredu šake cirkularom na poslu ili kod kuće. Svi pacijenti su lečeni operativno u jednom centru. Pacijenti su bili dominantno muškog pola i prosečne starosti od 48,6 ± 14,71 godina. Podaci o lokalizaciji, tipu i vrsti povrede, dominantnosti povređene ruke, vrsti operativnih intervencija i dužini hospitalizacije, prikupljeni su iz medicinske dokumentacije.

Rezultati: Učestalost povrede nedominantne ruke (62%) bila je veća, pri čemu je to češće bila leva ruka (60% slučajeva). Najveći broj (83,2%) pacijenata je povredu zadobio u kućnim uslovima, dok je na radnom mestu povređen značajno manji broj (16,7%) pacijenata. Najčešće su bile u pitanju udružene povrede različitih tkiva, dok je izolovanih povreda bilo samo 12,5%. Najčešće povređene strukture su bile tetive ekstenzora ručja i prstiju (245), a zatim falange (226). Najčešće je bio povređen jedan prst (35,1%), i to palac (68,4%), potom dva prsta (32,7%), dok su tri prsta bila povređena u 20% slučajeva. Povreda na nivou šake se javila u 7,27%, a na nivou podlaktice u 5,45% slučajeva. Od ukupno 995 izvedenih operacija, najčešća je bila tenorafija (44,67%), a zatim fiksacija preloma (29,3%). Reamputacija prstiju je rađena u 6,67% slučajeva, neurorafija kod 6% pacijenata, a reinsercija tetiva kod 4% slučajeva. Bilo je 46 (4,67%) replantacija, te 27 (2,67%) revaskularizacija. Prosečna dužina boravka u bolnici je bila 9,04 ± 3,91 dan.

Zaključak: Rad sa cirkularom predstavlja aktivnost visokog rizika. Zadobijene povrede su izuzetno teške, mogu prouzrokovati značajan funkcionalni deficit, a imaju i velike socioekonomske posledice. Nedostatak prethodne obuke za rad i nepravilno rukovanje predstavljaju jasne faktore rizika. Kliničko-epidemiološka analiza je stoga od izuzetnog značaja, jer može predstavljati ključ u prevenciji ovih povreda.

Ključne reči: povrede šake, cirkular, prevencija

ABSTRACT

Introduction: Hand injuries are extremely common. It is estimated that almost a quarter of all injuries treated in the emergency department are hand injuries, due to the fact that the hand is highly exposed to trauma, as the result of its function and its protective movement. These injuries are usually seen in the young working age population, and they involve simultaneous damage to several different tissues.

Aim: The purpose of this study is to evaluate the frequency and characteristics of hand injuries sustained by the circular saw, as well as to assess existing risk factors, in order to improve the prevention of these injuries.

Materials and methods: This is a retrospective study involving 365 patients, treated during a five-year period. The patients suffered hand injury with a circular saw, either at home or at work. All patients were surgically treated at a single medical center. The patients were mostly men, with an average age of 48.6 ± 14.71 years. The data, which was collected from the medical records, included localization and type of injury, dominance of the injured hand, the type of surgical procedures performed, and the length of hospital stay.

Results: The non-dominant hand was injured more often (62%), and this was usually the left hand (60%). The majority (83.2%) of patients were injured at home, while significantly less patients were injured in the workplace (16.7%). Most often, the patients sustained injuries to several different tissues, while there were only 12.5% of isolated injuries. The most commonly injured structures were extensor tendons of the wrist and fingers (245), followed by phalanges (226). Most of the patients sustained injury to one finger (35.1%), especially the thumb (68.4%), while two fingers were injured in 35.1% and three fingers in 20% of cases. The hand was injured in 7.27% of the cases, and the forearm was injured in 5.45% of the cases. Of the 995 surgical procedures carried out in total, the most commonly performed operation was tenorrhaphy (44.67%), followed by fracture fixation (29.3%). Finger reamputation was performed in 6.67% of cases, neurorrhaphy in 6%, and tendon reinsertion in 4% of cases. There was a total of 46 replantations (4.67%), and 27 revascularizations (2.67%). The average length of hospital stay was 9.04 ± 3.91 days.

Conclusion: Working with a circular saw is a high-risk activity. The injuries sustained are severe. They can result in significant functional deficit and have major socioeconomic consequences. Lack of prior training and improper handling are clear risk factors. Clinical and epidemiological analysis is therefore of extreme importance, as it can be the key to the prevention of these injuries.

Key words: hand injury, circular saw, prevention

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UVOD

Gornji ekstremiteti, a pogotovo šake, predstavljaju delove tela najčešće pogođene traumom [1]. Procenjuje se da je četvrtina svih povreda zbrinutih u hitnoj službi povezana sa šakom [2]. Ove se povrede najčešće sreću među radno aktivnom populacijom, zaposlenom u industrijskim pogonima, u kojima radnici dolaze u kontakt sa mašinama, ali i u drugim profesijama, zbog sve češće, i to nepravilne upotrebe ručnih alata sa motorom, najčešće cirkulara. Cirkular je kružna motorna testera na električni pogon, koja u zavisnosti od tipa i modela, ima od 2.000 do 5.000 obrtaja u minutu [3]. Koristi se u industriji, ali se može kupiti i na slobodnom tržištu i upotrebljavati u kućnim uslovima, bez bilo kakve prethodne obuke. Radi se o povredama visoko energetskog tipa, koje su čest uzrok teških oštećenja šake, sa značajnim oštećenjima više tkiva (Slika 1), koja u 57% slučajeva dovode do amputacije [4]. Ove povrede imaju veliki socioekonomski značaj, usled primarnih troškova lečenja (troškovi operacije i bolničkog lečenja), ali i sekundarnih troškova (izgubljene plate, prekvalifikacije i invaliditeti, kao i dugi period rehabilitacije) [5,6,7].

Slika 1. Povrede šake zadobijene cirkularom

Figure 1. Circular saw injuries to the hand

MATERIJALI I METODE

Ovo je retrospektivna studija sprovedena u jednom centru, u periodu od 2017. do 2021. godine. Na Odeljenju za rekonstruktivnu mikrohirurgiju i hirurgiju šake Univerzitetskog kliničkog centra Srbije, lečeno je 365 pacijenata povređenih cirkularom, koji su zadobili povredu šake, ručnog zgloba ili podlaktice. Iz studije su isključene povrede nanete ostalim mašinama. Iz medicinske dokumentacije (karton sa prijema i otpusna li-

INTRODUCTION

The upper extremities, especially hands, are body parts most commonly affected by injury [1]. It is estimated that a quarter of all injuries treated in the emergency department are related to the hand [2]. These injuries are usually seen in the young working age population employed in industrial plants, where workers are in direct contact with machines, but also in other professions, due to the more and more common, and very often inappropriate use of powered hand tools, most frequently circular saws. The circular saw is a round rotating electrical power saw, which, depending on the make and model, has 2,000 to 5,000 revolutions per minute (RPM) [3]. It is used in industry, but it is also freely available retail, and can be used at home, without any previous training. These are high-energy type injuries, which are a common cause of severe damage to the hand, with significant simultaneous damage to different tissues (Figure 1), which in 57% of cases lead to amputation [4]. These injuries are of great socioeconomic significance, due to primary treatment costs (costs of surgery and hospital treatment), but also to secondary costs (lost wages, vocational retraining, and disability, as well as a long rehabilitation period) [5,6,7].

MATERIALS AND METHODS

This is a retrospective study carried out at a single medical center, between 2017 and 2021. A total of 365 patients, who had sustained circular saw injury to the hand, wrist, or forearm, were treated at the Department of Microsurgery and Reconstructive Hand Surgery of the University Clinical Center of Serbia. Injuries inflicted by other machines were excluded from the study. The demographic patient data – age of patient at the time of injury, sex, and occupation, were collected from the patient medical records (patient admission report and discharge summary). Data on the localization and type of injury, dominance (handedness) of the injured hand, the type of surgical procedures performed, and the length of hospital stay, were also collected. Additionally, data on the way that the machine was operated and on previous training pertaining to circular saw handling, were recorded.

Statistical analysis produced results on the arithmetic mean, maximum and minimum values, standard deviation, and the frequency expressed in percentages.

RESULTS

Of the 365 patients injured by the circular saw, in the observed five-year period, there were 350 (95.8%) male and 15 (4.2%) female patients. The average age was 48.6 ± 14.71 years, with the age range of 17 to 88 years.

sta) prikupljeni su demografski podaci: godine pacijenta u momentu povređivanja, pol i profesija. Prikupljeni su i podaci o lokalizaciji i tipu povrede, dominantnosti povređene ruke, vrsti operativnih intervencija i dužini hospitalizacije. Zabeleženi su i podaci o načinu korišćenja mašine i prethodnoj obuci za rad sa cirkularom.

Statističkom obradom su dobijeni podaci o aritmetičkoj sredini, maksimalnim i minimalnim vrednostima, standardnoj devijaciji i učestalosti izraženoj u procentima.

REZULTATI

Od 365 pacijenata povređenih cirkularom, u periodu od pet godina, bilo je 350 (95,8%) osoba muškog pola i 15 (4,2%) osoba ženskog pola. Prosečne godine starosti su bile 48,6 ± 14,71 godina, sa rasponom od 17 do 88 godina. Najveći broj pacijenata je povredu zadobio u kućnim uslovima (83,2%), dok je na radnom mestu povređen značajno manji broj (16,7%) osoba. Prema zanimanju, struktura pacijenata je bila: 146 (40%) fizičkih radnika, 80 (21,9%) poljoprivrednika, 22 (6,05%) studenata i učenika, 117 (32,05%) penzionera. Najčešće je povređivana leva, nedominantna ruka, u 56% slučajeva, desna dominantna ruka povređivana je u 34% slučajeva, dok su desna nedominantna i leva dominantna ruka povređivane znatno ređe (6% odnosno 4% slučajeva). Najčešće je povređivan jedan prst (35,1%), i to palac (68,4%), potom dva prsta (32,7%), dok su tri prsta bila povređena u 20% slučajeva. Povreda na nivou šake se javila u 7,27% slučajeva, a na nivou podlaktice u 5,45%. Izolovane povrede samo jedne strukture su bile izuzetno retke, svega 12,5% pacijenata. Lokalizacija povreda je prikazana u Tabeli 1.

Najčešće povređene strukture su bile ekstenzorne tetive (245), a zatim falange (226). Kod svih povreda, bilo da je povređena samo tetiva ili i kost, postojala je povreda jednog ili oba digitalna živca, dok su, na nivou ručnog zgloba i podlaktice, bili povređeni *nervus*

Most of the patients sustained their injury at home (83.2%), while a significantly smaller number of persons (16.7%) was injured at their workplace. The structure of the patient sample was as follows: 146 (40%) manual laborers, 80 (21.9%) agricultural workers/farmers, 22 (6.05%) high-school and college students, 117 (32.05%) old-age pensioners. The left non-dominant hand was most commonly injured, in 56% of cases. The right dominant hand was injured in 34% percent of cases, while the right non-dominant hand and the left dominant hand were injured much less frequently (6% and 4% of cases, respectively). Most frequently the injury was to one finger (35.1%), predominantly the thumb (68.4%), followed by injury to two fingers (32.7%), while three fingers were injured in 20% of the cases. Hand injury occurred in 7.27% of cases, and forearm injury occurred in 5.45% of cases. Isolated injuries to only one structure were quite rare, only in 12.5% of patients. The injury localization is presented in Table 1.

The most commonly injured structures were extensor tendons (245), followed by phalanges (226). In all injuries, whether the damage was done only to the tendon or to the bone as well, injury to one or both digital nerves occurred, while, at the level of the wrist and forearm, damage was done to the *nervus medianus*, the *nervus ulnaris,* or both. The details on the damaged structures are presented in Table 2.

All patients were surgically treated. In total, 995 procedures were performed. The most commonly performed operation was tenorrhaphy (44.67%), followed by fracture fixation (29.3%). Finger reamputation was performed in 6.67% of cases, neurorrhaphy in 6%, and tendon reinsertion in 4% of cases. There was a total of 46 replantations (4.67%), and 27 revascularizations (2.67%). Skin defect was covered by a split-thickness skin graft in 2% of cases. The average length of hospital stay was 9.04 ± 3.91 days, with a range of 3 to 29 days.

Tabela 1. Lokalizacija povrede

Table 1. Injury localization

Lokalizacija povrede / *Injury localization*	**Prsti / *Fingers***				
Jedan prst / *One finger*	I	II	III	IV	V
	86	26	7	/	7
Dva prsta / *Two fingers*	I + II	II + III	I + III	III + IV	IV + V
	33	53	7	13	13
Tri i više prstiju / *Three or more fingers*	I – III	I – IV	II – IV	II – V	III – V
	13	7	20	27	6
Šaka / Hand	27				
Podlaktica / *Forearm*	20				

Tabela 2. Distribucija povređenih struktura

Table 2. Distribution of injured structures

Struktura / Structure						
Ekstenzorna tetiva / *Extensor tendon*	EPL	EDC II/ EIP	EDC III	EDC IV	EDC V/ EDM	EKSTENZORI PODLAKTICE
	66	46	40	20	13	60
Fleksorna tetiva / *Flexor tendon*	FPL	FDS/FDP II	FDS/FDP III	FDS/FDP IV	FDS/FDP V	FLEKSORI PODLAKTICE
	46	73	40	20	7	20
Metakarpalna kost / *Metacarpal bone*	I	II	III	IV	V	
	29	22	7	8	5	
Falanga / *Phalange*	I	II	III	IV	V	
	73	74	52	23	4	

EPL – extensor pollicis longus; EDC – extensor digitorum communis; EIP – extensor indicis proprius; EDM- extensor digiti minimi; FPL – flexor pollicis longus; FDS – flexor digitorum superficialis; FDP – flexor digitorum profundus

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medianus, *nervus ulnaris* ili oba. Detalji o povređenim strukturama su prikazani u Tabeli 2.

Svi pacijenti su operativno lečeni. Izvedeno je ukupno 995 procedura. Najčešća operacija je bila tenorafija (44,67%), a zatim fiksacija preloma (29,3%). Reamputacija prstiju je rađena u 6,67% slučajeva, neurorafija u 6%, a reinsercija tetiva u 4% slučajeva. Bilo je 46 replantacija (4,67%), te 27 (2,67%) revaskularizacija. Pokrivanje defekta kože transplantatom parcijalne debljine kože je urađeno u 2% slučajeva. Prosečna dužina hospitalizacije je iznosila 9,04 ± 3,91 dana, sa rasponom od 3 do 29 dana.

DISKUSIJA

U našoj studiji, bilo je 95,8% pacijenata muškog pola. Apsolutnu dominaciju muškog pola nalazimo u sličnim procentima i u drugim radovima [1,4,8]. Ovo se objašnjava većim angažovanjem muškaraca na poslovima koji su vezani za ručne alate sa motorom. Prosek godina pacijenata uključenih u studiju bio je 48,6 ± 14,71. U radovima drugih autora pronašli smo slične podatke: 46,8, odnosno 47 godina [4,8]. Samo u jednom radu je pronađen podatak o znatno nižem proseku godina (31,24 godine), što najvećim delom zavisi od starosne strukture populacije određene zemlje [1].

Relativno mali broj osoba (16,7%) je povredu zadobio na radnom mestu. Najveći broj je povredu zadobio u kućnim uslovima (sečenje drva u seoskim domaćinstvima, amaterska izrada predmeta od drveta ili ređe hobi). Skoro isti odnos nalazimo i u literaturi [9]. Ovakva razlika se može objasniti činjenicom da su ljudi u industriji obučeni za rad sa ovim mašinama. Prilikom uzimanja podataka o prethodnoj obuci za rad sa cirkularom, od svih pacijenata iz druge grupe smo dobili podatak da nisu prošli nikakvu prethodnu obuku.

DISCUSSION

There were 95.8% of male patients in our study. The absolute dominance of the male sex can also be found in other studies, with similar percentages [1,4,8]. This is explained by the fact that men more commonly hold jobs that involve the use of powered hand tools. The average age of the patients involved in the study was 48.6 ± 14.71. In studies by other authors, we found similar data: 46.8 and 47 years [4,8]. Only in one study did we find data on a significantly younger average age (31.24 years), which predominantly depends on the age structure of the population of a particular country [1].

A relatively small number of persons (16.7%) sustained their injury in the workplace. The majority of injuries was sustained in the home (cutting wood in rural households, amateur woodwork, or less frequently a hobby). Almost the same ratio can also be found in literature [9]. This difference can be attributed to the fact that people working in industry have been trained to work with these machines. When collecting data on previous training for operating a circular saw, all of the patients belonging to the second group stated that they had undergone no such training.

When we look at the frequency of injury to the left and right hands, the left hand was more commonly injured (60%). This can be explained by the fact that, when working with the circular saw, the dominant hand holds the machine, while the non-dominant hand holds the material being cut, near the blade, which is in correlation with the results presented in the study by Hassine et al. [1]. The population of Serbia is predominantly right-handed [10]. When working with table circular saws, both hands are at equal risk [9]. In the same way, the highest incidence of thumb injury

Kada se pogleda učestalost povrede leve i desne ruke, češće je povređivana leva ruka (60%). Ovaj podatak se može objasniti činjenicom da se, pri radu sa ručnim cirkularom, mašina drži u dominantnoj ruci, a da se nedominantnom rukom pridržava materijal u blizini sečiva, što je u korelaciji i sa rezultatima u radu Hasina i saradnika [1]. Populacija u Srbiji je uglavnom desnoruka [10]. Pri radu sa stonim cirkularima, pod podjednakim rizikom su obe ruke [9]. Na isti način se objašnjava i najveća učestalost povrede palca (kada je povređen samo jedan prst, na palac otpada 68,4% slučajeva), odnosno radijalne strane šake, kada su povređena dva prsta (78,1%). Ovi prsti se pri radu nalaze najbliže sečivu [4]. Najčešću povredu jednog prsta, palca i radijalne strane šake, navode i drugi autori [4,5,9].

Od struktura, najučestalije su bile povređivane tetive, približno podjednako tetive ekstenzora i tetive fleksora (245 prema 206). Veliku učestalost tetivnih povreda, posebno ekstenzornih tetiva, navode i drugi autori [1,11]. Najčešća operativna procedura je bila tenorafija (44,67%), a potom fiksacija preloma (29,3%). Ukupni broj reamputacija je bio 66 (6,67%), dok je u jednoj drugoj studiji nađeno da je upravo reamputacija bila najčešća primarna procedura [1]. Da li će se uraditi reamputacija ili replantacija zavisi od nivoa i težine povrede, ali i od dostupnosti specijalizovanih ustanova tercijarnog tipa. Najčešće je bila urađena reamputacija drugog i trećeg prsta (60%), kao što se navodi i u radu Hasina i saradnika [1]. Replantacije prstiju i šake su izvršene u 4,6% slučajeva (46 pacijenata), (Slika 2). S obzirom na samu prirodu povrede, koja uključuje avulziju i široku zonu povrede tkiva (Slika 3), kao i oštećenja finih neurovaskularnih struktura, operativno lečenje, u smislu replantacije, može biti veliki izazov.

Slika 2. Replantacija drugog i trećeg prsta

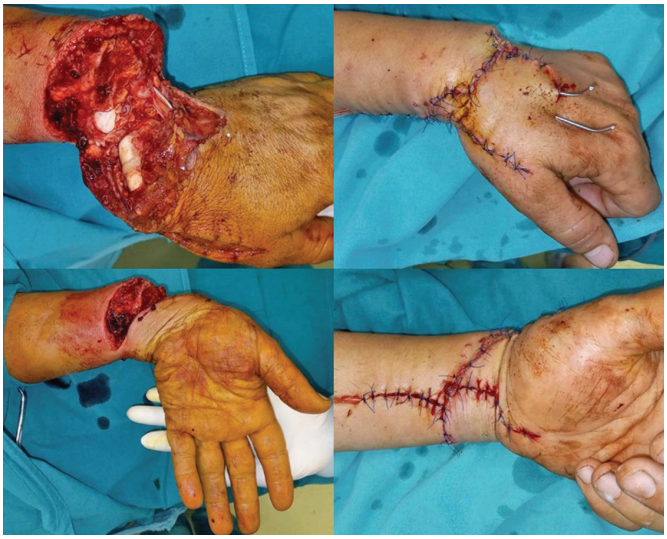
Figure 2. Replantation of the second and third finger

ZAKLJUČAK

S obzirom na samu prirodu alata (veliki broj obrtaja i oštrina sečiva), rad sa cirkularom predstavlja aktivnost

is explained (when only one digit is injured, thumb injuries account for 68.4% of such cases), as is the incidence of injury to the radial side of the hand, when two fingers are injured (78.1%). When working, these fingers are closest to the blade [4]. The injury to one digit, the thumb and the radial side of the hand, is also stated by other authors [4,5,9].

Of all the structures, tendons were the ones most commonly injured – approximately equally extensor and flexor tendons (245 versus 206). Other authors also reported a high incidence in tendon injury, especially extensor tendons [1,11]. The most frequently performed surgical procedure was tenorrhaphy (44.67%), followed by fracture fixation (29.3%). The total number of reamputations was 66 (6.67%), while in a different study, it was found that reamputation was, in fact, the most frequent primary procedure [1]. Whether reamputation or replantation is to be performed, depends on the level and severity of the injury, but also on the availability of specialized tertiary institutions. Most frequently, reamputation of the second and third finger was performed (60%), as is also reported in the study by Hassine et al. [1]. Replantation of the fingers and the hand was performed in 4.6% of the cases (46 patients), (Figure 2). Bearing in mind the nature of the wound itself, which includes avulsion and a wide tissue injury zone (Figure 3), as well as the damage to fine neurovascular structures, surgical treatment, in the sense of replantation, may pose a significant challenge.



Slika 3. Široka zona povrede sa elementima avulzije

Figure 3. Wide zone of injury with elements of avulsion

CONCLUSION

Due to the very nature of the tool itself (high RPM and sharp blade), operating a circular saw is a high-risk ac-

visokog rizika. Zadobijene povrede su izuzetno teške, mogu prouzrokovati značajni funkcionalni deficit, a imaju i velike socioekonomske posledice. Nedostatak prethodne obuke za rad i nepravilno rukovanje, usled skidanja predviđene zaštite, predstavljaju jasne faktore rizika za povređivanje. Kliničko-epidemiološka analiza povreda je stoga od izuzetnog značaja, jer može predstavljati ključ u prevenciji ovih povreda.

Sukob interesa: Nije prijavljen.

tivity. The injuries sustained are extremely severe, they can cause significant functional deficit, and they also have great socioeconomic impact. Lack of previous training on how to properly operate the machine and the misuse of this tool, resulting from the removal of the protective parts of the machine, represent obvious risk factors for injury. The clinical and epidemiological analysis of the injuries is, therefore, exceptionally significant, as it can be the key to preventing these injuries.

Conflict of interest: None declared.

LITERATURA / *REFERENCES*

1. Hadj Hassine Y, Hmid M, Baya W. Trauma of the hand from circular saw table: a series of 130 cases. Tunis Med. 2016 Dec;94(12):851. PMID: 28994884.
2. Gordon AM, Malik AT, Goyal KS. Trends of hand injuries presenting to US emergency departments: A 10-year national analysis. Am J Emerg Med. 2021 Dec;50:466-71. doi: 10.1016/j.ajem.2021.08.059.
3. Testera kružna stacionarna (prospekt proizvođača), HS100E, Womax, Lammstrasse 81, Heidenheim, Nemačka 2017.
4. Sabongi RG, Erazo JP, Moraes VY, Fernandes CH, Santos JBGD, Faloppa F, et al. Circular saw misuse is related to upper limb injuries: a cross-sectional study. Clinics (Sao Paulo). 2019;74:e1076. doi: 10.6061/clinics/2019/e1076.
5. Frank M, Hecht J, Napp M, Lange J, Grossjohann R, Stengel D, et al. Mind your hand during the energy crunch: Functional Outcome of Circular Saw Hand Injuries. J Trauma Manag Outcomes. 2010 Sep 6;4:11. doi: 10.1186/1752-2897-4-11.
6. Trybus M, Lorkowski J, Brongel L, Hladki W. Causes and consequences of hand injuries. Am J Surg. 2006 Jul;192(1):52-7. doi: 10.1016/j.amjsurg.2005.10.055.
7. Fikry T, Saidi H, Latifi M, Essadki B, Zryouil B. La main traumatique par toupie: pour une meilleure prévention [Hand trauma from table saw: best prevention]. Chir Main. 2004 Apr;23(2):96-9. French. doi: 10.1016/j.main.2004.02.001.
8. Hoxie SC, Capo JA, Dennison DG, Shin AY. The economic impact of electric saw injuries to the hand. J Hand Surg Am. 2009 May-Jun;34(5):886-9. doi: 10.1016/j.jhsa.2009.02.002.
9. Frank M, Lange J, Napp M, Hecht J, Ekkernkamp A, Hinz P. Accidental circular saw hand injuries: trauma mechanisms, injury patterns, and accident insurance. Forensic Sci Int. 2010 May 20;198(1-3):74-8. doi: 10.1016/j.forsciint.2010.01.003.
10. Cvetković M, Vasiljević P. Handedness and phenotypic characteristics of the head and face. Genetika. 2015; 47(2):723-31.
11. Al-Qattan MM. Saw injuries causing phalangeal neck fractures in adults. Ann Plast Surg. 2012 Jul;69(1):38-40. doi: 10.1097/SAP.0b013e31821ee453.