FUNKCIONALNI REZULTATI LEČENJA PACIJENATA SA POVREDOM MEKIH TKIVA VOLARNE STRANE RUČNOG ZGLOBA

SERIJA SLUČAJEVA

CASE SERIES

FUNCTIONAL RESULTS IN THE TREATMENT OF PATIENTS WITH SOFT TISSUE INJURIES TO THE VOLAR ASPECT OF THE WRIST

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SAŽETAK

Uvod: Šaka je izuzetno važan deo tela kompleksne anatomije. U njoj se nalaze važni neurovaskularni elementi. Mnoge površinske povrede šake, naizgled trivijalne, često su povezane sa povredama tetiva, nerava i krvnih sudova. Istraživanje se odnosi na povrede mekih tkiva, dok su povrede kostiju isključene iz studije.

Cilj rada: Cilj rada je da se prikaže funkcionalni rezultat lečenja pacijenata sa povredom mekih tkiva volarne strane ručnog zgloba.

Metode: Izvršena je retrospektivna analiza 20 pacijenata lečenih na Odeljenju mikrohirurgije Urgentnog centra u Beogradu. Ispitivali smo: grubu motornu snagu šake (GMS), opseg pokreta, test diskriminacije dve tačke (engl. *two-point discrimination test – 2PD*), a pacijenti su popunjavali Upitnik za procenu invaliditeta ruku, šaka i ramena (*the Disabilities of the Arm, Shoulder and Hand – DASH questionnaire*).

Rezultati: U našoj studiji, GMS povređene ruke bila je 80,9 % snage nepovređene ruke. Srednji opseg pokreta ručnog zgloba, kao i *DIP*, *PIP* i *MCP* zglobova, bio je u rasponu od 77,45 % do 91,6 %, u odnosu na nepovređenu ruku. Senzorni oporavak nivoa S3+ dostiglo je 10 % pacijenata. Prosečni *DASH* skor je bio 19,78.

Zaključak: Naše istraživanje pokazuje da je pravilno i blagovremeno lečenje neophodno za dobar funkcionalni rezultat lečenja ovih povreda.

Ključne reči: gruba motorna snaga, srednji opseg pokreta, senzorni oporavak

ABSTRACT

Introduction: The hand is a very important body part with complex anatomy. Important neurovascular structures are located in the hand. Many superficial injuries of the hand, which may at first glance appear harmless, are often associated with injuries to tendons, nerves, and blood vessels. This paper describes soft tissue injuries, while injuries to the bone have been excluded from the study.

Aim: The aim of this study is to present the functional outcome of the treatment of patients with soft tissue wounds to the volar aspect of the wrist.

Methods: A retrospective analysis of 20 patients treated at the Microsurgery Department of the Emergency Center in Belgrade was performed. We observed the following: gross grip strength (GGS) of the hand, range of motion, the two-point discrimination test (2PD), while the patients filled out the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire.

Results: In our study, the GGS of the injured hand was 80.9% of the strength of the uninjured hand. The mean range of motion of the wrist, as well as of the DIP, PIP, and MCP joints, ranged from 77.45% to 91.6%, as compared to the uninjured hand. An S3+ level of sensory recovery was achieved by 10% of patients. The average DASH score was 19.78.

Conclusion: Our study shows that proper and timely treatment is necessary for a good functional result in the treatment of these injuries.

Keywords: gross grip strength, mean range of motion, sensory recovery

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UVOD

Anatomski, predeo ručja (*carpus*) čini osam malih kostiju povezanih ligamentima i zglobnim kapsulama. Kosti su poređane u dva reda: gornji red čine *os scaphoideum*, *os lunatum*, *os triquetrum* i *os pisiforme*, dok donji red sačinjavaju *os trapezium*, *os trapezoideum*, *os capitatum* i *os hamatum*. Na prednjoj strani se nalazi vertikalni žleb ručja (*sulcus carpi*) kojeg bočno ograničavaju dva uzvišenja – spoljašnje i unutrašnje. Ova dva ispupčenja povezuje poprečna veza (*retinaculum flexorum s. lig. carpi transversum*). Poprečna veza sa žlebom ručja obrazuje osteofibrozni kanal (lat. *canalis carpi*) kojim prolaze tetive pregibača prstiju kao i *n. medianus* [1]. Devet fleksornih tetiva prolazi kroz karpalni tunel i ulazi u dlan. Tetiva površinskog pregibača se deli blizu metakarpofalangealnih zglobova (lat. *articulationes metacarpophalangeae – MCP*) na dva kraka, između kojih prolazi tetiva dubokog fleksora. Površinski fleksor se pripaja na palmarnoj strani medijalne falange, a duboki fleksor nastavlja put kroz fleksorni kanal do pripoja na palmarnoj strani distalne falange. Fleksorne tetive prolaze kroz fibroosealne kanale [1]. Inervacija potiče od *n. medianus*-a i *n. ulnaris-a* koji prolaze dubokom stranom tetive *m. flexor carpi ulnaris*-a i ulaze u Gijonov kanal. *N. medianus* prolazi ispod i između *m. flexor carpi radialis*-a i *m. palmaris longus*-a i ulazi u karpalni kanal. *Nervus ulnaris* daje senzitivnu inervaciju petog prsta, medijalne polovine četvrtog prsta i njima pripadajućeg dela dlana. U šaci, duboka grana ulnarnog nerva inerviše mišiće hipotenara *(m. opponens digiti minimi, m. abductor digiti minimi, m. flexor digiti minimi brevis*), treći i četvrti lumbrikalni mišić, dorzalne i palmarne interosealne mišiće, *m. adductor pollicis* i duboku granu *m. flexor pollicis brevis*-a, dok superficijalna grana inerviše *m. palmaris brevis*. U šaci, *n. medianus* daje rekurentnu granu za mišiće tenara (*m. opponens pollicis, m. abductor pollicis brevis* i površinski deo *m. flexor pollicis brevis*-a), zajedničke i posebne palmarne grane za prste, koje senzorno inervišu prva tri prsta i radijalnu stranu četvrtog prsta. Arterijsku mrežu krvnih sudova šake formiraju *a. radialis* i *a. ulnaris*. Obe ove arterije se u visini ručja granaju formirajući *arcus palmaris superficialis*. Površinski arkus se nalazi neposredno ispod palmarne fascije, a čine ga površinska grana *a. radialis* (*ramus palmaris superficialis art. radialis*) i *a. ulnaris*. *Ramus palmaris superficialis* daje četiri *aa. digitales palmares communes*, koje se u visini *MCP* zglobova granaju dajući *aa. digitales palmares propriae*. U nivou distalne falange formiraju *rete arteriosum* [2]. Arterija radialis, pre nego što da granu za površinski arkus, daje granu za palac (*a. princeps pollicis*), koja se račva na dve arterije u visini glavice prve metakarpalne kosti. Duboki palmarni arkus obrazuju *a. radialis* i *ramus profundus a. ulnaris*, u

INTRODUCTION

Anatomically, the region of the wrist (Lat. *carpus*) consists of eight small bones connected by ligaments and joint capsules. The bones are arranged in two rows: the upper row consists of the scaphoid bone (Lat. *os scaphoideum*), the lunate bone (Lat. *os lunate*), the *triquetral* bone (Lat. os triquetrum), and the pisiform bone (Lat. *os pisiforme*), while the lower row consists of the trapezium bone (Lat. *os trapezium*), the trapezoid bone (Lat. *os trapezoideum*), the capitate bone (Lat. *os capitatum*), and the hamate bone (Lat. *os hamatum*). On the anterior aspect, there is a vertical carpal groove (Lat. *sulcus carpi*), which is laterally limited by two elevations – external and internal. These two protrusions are connected by a transverse ligament (Lat. *retinaculum flexorum s. lig. carpi transversum*). The transverse connection with the carpal groove forms an osteofibrous canal (Lat. *canalis carpi*) through which the tendons of the flexors of the fingers, as well as the median nerve (Lat. *n. medianus*) pass [1]. Nine flexor tendons pass through the carpal tunnel and enter the palm. The superficial flexor tendon divides near the metacarpophalangeal joints (Lat. *articulationes metacarpophalangeae*; MCP) into two branches. The deep flexor tendon passes between these two branches. The superficial flexor attaches on the palmar side of the medial phalanx, while the deep flexor continues through the flexor canal to its attachment on the palmar side of the distal phalanx. Flexor tendons pass through fibro-osseous canals [1]. Innervation comes from the median nerve and the ulnar nerve (Lat. *n. ulnaris*), which pass along the deep side of the tendon of the *m. flexor carpi ulnaris* and enters the Guyon canal. The median nerve passes underneath and between the *m. flexor carpi radialis* and the *m. palmaris longus* and enters the carpal tunnel. The ulnar nerve provides sensory innervation of the fifth finger, the medial half of the fourth finger, and the corresponding part of the palm. In the hand, the deep branch of the ulnar nerve innervates the hypothenar muscles (*m. opponens digiti minimi, m. abductor digiti minimi, m. flexor digiti minimi brevis*), the third and fourth lumbrical muscles, the dorsal and palmar interosseous muscles, the *m. adductor pollicis*, and the deep branch of the *m. flexor pollicis brevis*, while the superficial branch of the ulnar nerve innervates the *m. palmaris brevis*. In the hand, the median nerve gives off a recurrent branch for the thenar muscles (*m. opponens pollicis*, *m. abductor pollicis brevis*, and the superficial part of the *m. flexor pollicis brevis*), as well as common and individual palmar branches for the fingers, which provide sensory innervation the first three fingers and the radial aspect of the fourth finger. The arterial network of blood vessels of the hand is formed by the ra-

visini baza kostiju područja. Duboki palmarni arkus daje završne grane za mišiće i zglobove [3].

Povrede mekih tkiva, zglobova i kostiju podlaktice su veoma česte na odeljenjima za hitne slučajeve. Postoje velike varijacije u ozbiljnosti povreda, od malih lacerација, koje uključuju samo kožu, do ekstenzivnih povreda, čak i gubitka ekstremiteta. I najtrivijalnije rane mogu biti povezane sa oštećenjem tetive ili nerva, što, ukoliko se propusti, može imati trajne funkcionalne posledice po pacijenta. Iako se istraživanje odnosi na meka tkiva, a ne na povrede kostiju, nije ih moguće u potpunosti odvojiti. U nekim slučajevima, komponenta mekih tkiva je mnogo važnija od preloma, a propust u dijagnostici ima za posledicu loš ishod [4]. Cilj ovog istraživanja je da se prikaže funkcionalni rezultat pacijenata sa povredom mekih tkiva volarne strane ručnog zgloba.

MATERIJALI I METODE

Ovo je retrospektivna studija koja je obuhvatila 20 pacijenata, od kojih 16 muškog a četiri ženskog pola, prosečne starosti 48,25 godina (u rasponu od 35 do 68 godina), lečenih na Odeljenju mikrohirurgije Urgentnog centra, u periodu od 01. 10. 2014. godine do 01.10.2016. godine. Sledeće varijable su analizirane u ovoj grupi pacijenata: pol, godine života, zanimanje, mehanizam povrede, dominantnost ruke i koja je ruka povređivana.

Operisani pacijenti su lečeni unutar 48 sati, u opštoj ili regionalnoj anesteziji. Nakon obrade rane, rađena je sutura tetiva neresorptivnim koncem 2/0, i arterija i nerava koncem 8/0, uz upotrebu mikroskopa. Postoperativno, plasirana je nadlakatna gips šina sa prstima u fleksiji u trajanju od četiri nedelje. Svi pacijenti su primali antibiotsku terapiju, antitetanusnu zaštitu, OHB 12 i niskomolekularni heparin. Posle skidanja imobilizacije pacijenti su upućeni na fizikalnu terapiju.

Procenu smo vršili nakon minimum šest meseci od povređivanja. Merili smo: grubu motornu snagu šake (GMS), opseg pokreta, test diskriminacije dve tačke (engl. *two-point discrimination test – 2PD*), a pacijenti su popunjavali Upitnik za procenu invaliditeta ruku, šaka i ramena (*the Disabilities of the Arm, Shoulder and Hand – DASH questionnaire*). GMS smo testirali dinamometrom. Testirane su povređena i zdrava ruka, a rezultati su izraženi u procentima, u odnosu na nepovređenu ruku. Goniometrom je određivan opseg pokreta u ručnom zglobu, interfalangealnom zglobu (lat. *articulatio interphalangealis – IP*) palca, te distalnom interfalangealnom zglobu (lat. *articulatio interphalangealis distalis – DIP*), proksimalnom interfalangealnom zglobu (lat. *articulatio interphalangealis proximalis – PIP*) i metakarpofalangealnom zglobu (lat. *articulatio metacarpophalangealis – MCP*) ostalih prstiju.

dial artery and the ulnar artery (Lat. *a. radialis* and *a. ulnaris*). Both of these arteries branch off at the level of the palm forming the superficial palmar arch (Lat. *arcus palmaris superficialis*), which is located directly below the palmar fascia, and is made up of the superficial branch of the radial artery (Lat. *ramus palmaris superficialis art. radialis*) and the ulnar artery. The superficial branch of the radial artery gives off four common palmar digital arteries (Lat. *aa. digitales palmares communes*), which branch off at the level of the MCP joints, into the proper palmar digital arteries (Lat. *aa. digitales palmares propriae*). At the level of the distal phalanx, they form the *rete arteriosum* [2]. The radial artery, before giving off a branch for the superficial arch, gives off a branch for the thumb (*a. princeps pollicis*), which branches into two arteries at the level of the head of the first metacarpal bone. The deep palmar arch is formed by the radial artery and the deep palmar branch of the ulnar artery (Lat. *ramus profundus a. ulnaris*), at the level of the bases of the metacarpal bones. The deep palmar arch provides terminal branches for muscles and joints [3].

Injuries to the soft tissues, joints, and bones of the forearm are very common in emergency departments. There is great variation in the severity of the injuries, ranging from small lacerations involving only the skin, to extensive injuries, or even loss of a limb. Even the most trivial wounds can be associated with tendon or nerve damage, which, if missed, can have permanent functional consequences for the patient. Although the present study deals with soft tissue injuries rather than injuries to the bone, it is not possible to completely separate them. In some cases, the soft tissue component of an injury is much more important than the fracture, and failure to diagnose this results in a poor outcome [4]. The aim of this study is to present the functional result of patients with soft tissue injury of the volar side of the wrist.

MATERIALS AND METHODS

This is a retrospective study which included 20 patients, of whom 16 male and four female, with the average age of 48.25 years (ranging from 35 to 68 years), treated at the Microsurgery Department of the Emergency Center, in the period between October 1, 2014 and October 1, 2016. The following variables were analyzed in this group of patients: sex, age, occupation, mechanism of injury, hand dominance, as well as which hand was injured.

The surgically treated patients were operated on within 48 hours, under general or regional anesthesia. After the wound was treated, tendons were sutured with non-absorbable 2/0 thread, while the arteries and

Kako bismo opisali dobijene rezultate, poredili smo ih sa rezultatima za zdravu ruku i predstavili pomoću *total active motion (TAM)* skale, koju je ustanovilo Američko udruženje za hirurgiju šake (engl. American Association for Hand Surgery). Prema ovoj skali, zbir aktivnog opsega pokreta za *MCP*, *PIP*, *DIP* zglobove se poredi sa *TAM* skorom kontralateralne strane ili normom od 260°. Ova skala opisuje četiri kategorije oporavka opsega pokreta: odlično (oporavak 100%), dobro (>75%), srednje dobro (>50%) i loše (<50%). Za praćenje oporavka senzibiliteta koristili smo *MRC* skalu (engl. *Medical Research Council (MRC) Scale for Sensory Recovery Following Peripheral Nerve Injury*) koja uzima u obzir: taktilni senzibilitet, vrednost *2PD*, bolni senzibilitet i prisustvo ili odsustvo hiperestezija. *2PD* test pokazuje najmanje rastojanje u milimetrima koje pacijent još uvek prepoznaje kao dve odvojene tačke. Dobijeni rezultati na *MRC* skali su se kretali od ocene S0, koja je označavala potpuni gubitak osećaja, do S4 koja je podrazumevala kompletan oporavak (diskriminacija dve tačke na rastojanju od 4 mm – 6 mm). Kroz *DASH* upitnik pacijenti su opisivali mogućnost obavljanja svakodnevnih aktivnosti. Rezultati se kreću od 0 – 100, gde je 0 najbolji, a 100 najslabiji rezultat.

REZULTATI

Kada je u pitanju način povređivanja, 12 pacijenata je zadobilo povrede staklom, 6 pacijenata se povredilo brusilicom, dok se dvoje povredilo nožem. Po zanimanju su pacijenti bili sledeće strukture: četiri penzionera, 6 nezaposlenih i 10 fizičkih radnika. Dvanaest pacijenata je povredilo dominantnu ruku. Gruba motorna snaga povređene ruke bila je 80,9 % snage nepovređene ruke (u rasponu od 65,7 % do 97,8%). Srednji opseg pokreta u poređenju sa nepovređenom rukom bio je 116,2° (91,6%) za ručni zglob, dok je za *DIP*, *PIP* i *MCP* zglobove opseg pokreta bio 222,5° (77,45%) za drugi prst, 227,5° (83,05%) za treći prst, 230° (91,2%) za četvrti prst i 218,7° (84,9%) za peti prst. Kod dva pacijenta je postojala i povreda tetive *musculus flexor pollicis* longus-a. U *IP* zglobu palca izmeren je obim pokreta od 90° koliki je bio i na nepovređenoj ruci. Deset pacijenata je imalo povredu *nervus*-a *ulnaris*-a, pet pacijenata je povredilo *nervus medianus*, dok je pet imalo povređena oba nerva. Pet slučajeva od deset tretiranih povreda *nervus*-a *ulnaris*-a je pokazalo senzorni oporavak nivoa S1, četiri su dostigla nivo S2, dok je jedan imao nivo S3+. Među pacijentima sa povredom *n. medianus*-a, četiri su dostigla nivo S3 a jedan je imao nivo S2. Kod pacijenata sa povredom oba nerva, dva su dostigla S3 nivo, dva S2 nivo, a jedan je imao S3+ nivo. Od svih slučajeva, S3+ nivo je dostiglo 10% pacijenata. Prosečan *DASH* skor je bio 19,78 (u rasponu od 51,66 do 0).

nerves were sutured with 8/0 thread, with the use of a microscope. Postoperatively, an above-the-elbow plaster splint was placed, with the fingers in flexion, for four weeks. All patients received antibiotic therapy, protection from tetanus, hydroxocobalamin, and low molecular heparin. After the casts were removed, the patients were referred for physical therapy.

We performed an assessment after a minimum of six months from the injury. We measured the following: gross grip strength (GGS) of the hand, range of motion, the two-point discrimination test (2PD), while the patients filled out the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. We tested the GGS with a dynamometer. Both the injured hand and the healthy hand were tested, and the results were expressed in percentages, as compared to the uninjured hand. A goniometer was used to determine the range of motion in the wrist, the interphalangeal joint (IP), (Lat. *articulatio interphalangealis*) of the thumb, as well as the distal interphalangeal joint (DIP), (Lat. *articulatio interphalangealis distalis*), the proximal interphalangeal joint (PIP), (Lat. *articulatio interphalangealis proximalis*), and the metacarpophalangeal joint (MCP), (Lat. *articulatio metacarpophalangealis*) of the other fingers.

In order to describe the results that were obtained, we compared them with the results for the healthy hand and presented them using the total active motion (TAM) scale, established by the American Association for Hand Surgery. According to this scale, the sum of the active range of motion for the MCP, PIP, DIP joints is compared with the TAM score of the contralateral side or the 260° norm. This scale defines four categories of range of motion recovery: excellent (100% recovery), good (>75%), fair (>50%), and poor (<50%). To monitor sensory recovery, we used the MRC scale (the Medical Research Council Scale for Sensory Recovery Following Peripheral Nerve Injury), which takes into account: tactile sensitivity, the 2PD value, pain sensitivity, and the presence or absence of hyperesthesia. The 2PD test shows the smallest distance in millimeters that the patient still recognizes as two distinct points. The results on the MRC scale ranged from S0, which indicated complete loss of sensation, to S4, which implied complete recovery (discrimination distance recognition of 4 mm – 6 mm). In the DASH questionnaire, patients described their ability to perform daily activities. The score range is from 0 – 100, with 0 being the best and 100 being the worst score.

RESULTS

Regarding the mechanism of injury, 12 patients were injured by glass, 6 patients were injured by a grinder, while two were injured by a knife. As to the patients'

DISKUSIJA

Povrede volarne strane ručnog zgloba mogu da dovedu do značajnih oštećenja mekih struktura, uglavnom zbog površinske lokalizacije i velikog broja tetiva, živaca i arterija u tom području [5]. Funkcionalni integritet šake zahteva intaktne neurovaskularne strukture i zglobove [6]. Blizina struktura predstavlja veliki izazov u njihovoj identifikaciji. Lečenje je posebno zahtevno u kombinovanim nervno-tetivnim povredama. Postoperativno, međustrukturne adhezije predstavljaju glavni problem. Produžena neaktivnost postoperativno povećava sklonost ka adhezijama, dok rana pokretljivost otežava zarastanje nerava [7]. Naše istraživanje je pokazalo da su se muškarci češće povređivali od žena. Naša studija takođe pokazuje da je češće povređivana dominantna ruka, što je u skladu sa studijom Ogemdija i saradnika [8]. Ova studija pokazuje da je najčešći mehanizam povređivanja bio nožem i staklom, što je pokazalo i naše istraživanje. Takođe, u ovom istraživanju je pokazano da su najčešće povređivani bili državni službenici, dok su u našoj studiji to bili fizički radnici. U našem radu je pokazano da srednji opseg pokreta, za sve opisane zglobove prema *TAM* skali, spada u kategoriju dobro (oporavak >75%), kao što pokazuje i studija Striklanda i saradnika [9]. GMS povređene ruke je u našoj studiji bila 80,9%, što je slično rezultatima Stefaničevog rada u kojem je GMS iznosila 79% [10]. U Časardovom radu, senzorni oporavak nivoa S3+ i više za *n. ulnaris* dostiglo je 26,5% pacijenata, a za *n. medianus* 31% pacijenata, dok naš rad takav oporavak pokazuje kod 10% pacijenata za oba nerva [11]. Prosečan *DASH* skor u ovoj studiji je bio 19,78, koji je u skladu sa rezultatima drugih studija [12,13]. U poređenju sa svetskim radovima (Strikland, Časard, Stefanič i drugi radovi), naši rezultati lečenja su slični ili identični.

ZAKLJUČAK

Povrede volarne strane ručnog zgloba su veoma teške za lečenje zbog velikog broja važnih neurovaskularnih elemenata koji se nalaze u toj regiji. Lezije *n. ulnaris*-a i *n. medianus*-a daju veliki procenat invalidnosti kod pacijenata. Ovo je važno, jer se radi o pacijentima prosečne starosti 48 godina, dakle radno aktivnih, zbog čega je važno pravilno lečiti i dobiti što je moguće bolji funkcionalni rezultat. Korist od toga ima i sam pacijent, ali i država zbog manjih troškova lečenja i mogućnosti pacijenta da nastavi rad u svojoj struci. Pravilno i blagovremeno hirurško lečenje je imperativ za dobar rezultat ovih povreda.

Sukob interesa: Nije prijavljen.

occupation, the group structure was as follows: four pensioners, 6 unemployed persons, and 10 manual workers. Twelve patients injured their dominant hand. The gross grip strength of the injured hand was 80.9% of the GGS of the uninjured hand (ranging from 65.7% to 97.8%). The mean range of motion compared to the uninjured hand was 116.2° (91.6%) for the wrist, while for the DIP, PIP, and MCP joints the range of motion was 222.5° (77.45%) for the second finger, 227, 5° (83.05%) for the third finger, 230° (91.2%) for the fourth finger, and 218.7° (84.9%) for the fifth finger. In two patients, there was an injury to the tendon of the *flexor pollicis longus*. In the IP joint of the thumb, a 90° range of motion was measured, which was the same as in the uninjured hand. Ten patients had an injury to the ulnar nerve, five patients had an injury to the median nerve, while five had injuries to both nerves. Five out of ten cases of treated ulnar nerve injuries showed S1 level sensory recovery, four patients achieved S2 level of recovery, while one had an S3+ level. Among the patients with median nerve injury, four achieved S3 level of recovery, while one had S2 level of recovery. In patients with injury to both nerves, two achieved S3 level, two achieved S2 level, while one achieved S3+ level of recovery. Out of all cases, S3+ level of recovery was achieved by 10% of patients. The mean DASH score was 19.78 (range: 51.66 – 0).

DISCUSSION

Injuries to the volar aspect of the wrist can lead to significant damage to soft-tissue structures, mainly due to the superficial localization and the large number of tendons, nerves and arteries in that area [5]. Functional integrity of the hand requires intact neurovascular structures and joints [6]. The closeness of the structures presents a major challenge in their identification. Treatment is particularly challenging in combined nerve-tendon injuries. Postoperatively, interstructural adhesions are a major problem. Prolonged inactivity postoperatively increases the tendency towards adhesions, while early mobility hinders nerve healing [7]. Our study has shown that men injured themselves more often than women. Our study also shows that the dominant hand is more often injured, which is in keeping with the study by Ogemdi et al. [8]. This study showed that the most common mechanisms of injury were knife and glass injuries, which our study has also shown. Additionally, this study showed that civil servants were injured most frequently, while in our study it was manual workers being injured the most. In our study, the average range of motion, for all the described joints, according to the TAM scale, fell into the category of good (recovery >75%), as also shown by the study

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by Strickland et al. [9]. The GGS of the injured hand in our study was 80.9%, which is similar to the results obtained in the study by Stefanich et al., where the GGS was 79% [10]. In the study by Chassard et al., sensory S3+ level recovery and higher for the ulnar nerve was achieved by 26.5% of patients, and by 31% of patients for the median nerve, while our study has shown such recovery in 10% of patients for both nerves [11]. The average DASH score in the present study was 19.78, which is consistent with the results of other studies [12,13]. When compared to other international studies (Strickland, Chassard, Stefanich, and other studies), our treatment results are similar or identical.

CONCLUSION

Injuries to the volar aspect of the wrist are very difficult to treat because of the large number of important neurovascular elements located in that region. Lesions to the ulnar nerve and the median nerve cause a high percentage of disability in patients. This is important, because these are patients with an average age of 48 years, i.e. working individuals, which is why it is important to treat them properly and get the best possible functional result. Both the patient and the state benefit from this, due to lower treatment costs and the patient's ability to continue working in his/her profession. Proper and timely surgical treatment is imperative for a good outcome in these injuries.

Conflict of interest: None declared.