

# Učestalost, vrsta i etiologija dentalnih i mekotkivnih ozljeda kod djece u Hrvatskoj

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Škaričić, Josip; Vuletić, Marko; Hrvatina, Sandra; Jeličić, Jesenka; Čuković-Bagić, Ivana; Jurić, Hrvoje

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# PREVALENCE, TYPE AND ETIOLOGY OF DENTAL AND SOFT TISSUE INJURIES IN CHILDREN IN CROATIA

Josip Škaričić<sup>1</sup>, Marko Vuletić<sup>2</sup>, Sandra Hrvatin<sup>3</sup>, Jesenka Jeličić<sup>4</sup>,  
Ivana Čuković-Bagić<sup>5</sup> and Hrvoje Jurić<sup>5</sup>

<sup>1</sup>Private Practice, Split; <sup>2</sup>Private Practice, Sisak; <sup>3</sup>Department of Pediatric Dentistry and Orthodontics, School of Medicine, University of Rijeka, Department of Dental medicine, Rijeka University Hospital Center, Rijeka; <sup>4</sup>Private Practice, Zagreb; <sup>5</sup>Department of Pediatric and Preventive Dentistry, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

**SUMMARY** – The prevalence, type and etiology of dental and soft tissue injuries and relationship between the time of arrival and sustaining soft tissue injury were analyzed in this retrospective study conducted at the Department of Pediatric Dentistry, University Dental Clinic in Zagreb, Croatia, during the 2010-2014 period using documentation on 447 patients (264 male and 183 female) aged 1-16 years with injuries of primary and permanent teeth. The highest prevalence of traumatic dental injury (TDI) was found in the 7-12 age group and maxillary central incisors were most frequently affected (80.9%) in both primary and permanent dentitions. Enamel-dentin fracture without pulp exposure (31.9%) was the most common TDI of dental hard tissue in both dentitions, whereas subluxation (27.3%) was the most common periodontal tissue injury type. The most frequent location, cause and seasonal variation of trauma were at home, falling and spring. Soft tissue injuries were observed in 203 (45.4%) patients. Soft tissue injuries were less likely when fewer teeth were traumatized ( $p < 0.001$ ). Comparison of children with and without soft tissue injuries yielded a statistically significant difference in the time to arrival between primary and permanent teeth ( $p < 0.01$ ). Because soft tissue injuries include bleeding and clinical presentation appears more dramatic, the time elapsed between injury and initial treatment was shorter than in non-bleeding injuries, pointing to the need of education focused on parents and school teachers regarding the importance of immediate therapy for both bleeding and non-bleeding TDIs.

**Key words:** *Tooth, deciduous; Dentition, permanent; Tooth injuries; Soft tissue injuries*

## Introduction

Orofacial injuries cause pain, as well as aesthetic, psychological, behavioral and functional problems among children with traumatized primary and permanent dentition<sup>1-4</sup>. Traumatic dental injuries (TDI) are surpassing dental caries and periodontal disease to become the major threat to young people's dental health<sup>1,5,6</sup>. Although oral area makes only 1% of human body, oral tissue injuries are the sixth most common

body injuries<sup>7</sup>. Studies have shown that 35%-50% of children have sustained traumatic injuries of primary and permanent dentition<sup>8,9</sup>.

The reviewed literature shows that males aged 10-12 years experience dental trauma most often, and the majority of trauma (71%-92%) occur before the age of 19<sup>10</sup>. Maxillary central incisors usually are the teeth that are most affected in both types of dentition. Recent studies have shown a reduction in gender difference due to the characteristics of Western society<sup>11</sup>. Generally, TDI in children and adolescents is associated with damage to the oral soft tissue (lips, tongue and gingiva). Oral soft tissue injuries connected to TDI are present in nearly half of all dental trauma patients<sup>12,13</sup>.

Correspondence to: *Marko Vuletić, DMD, Private Practice, Žitna 8, HR-44000 Sisak, Croatia*

E-mail: *vulesk@gmail.com*

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Glendor<sup>11</sup> presents four reasons why TDI is a public dental health problem. Because there are no recent studies of the prevalence of TDI in children in Zagreb, Croatia, the aim of this study was to analyze the prevalence, type and etiology of dental and soft tissue injuries. Furthermore, the study demonstrated the connection between TDI and soft tissue injuries and examined the relationship between the time of arrival and presence of soft tissue injury.

## Materials and Methods

This retrospective study was conducted at the Department of Pediatric Dentistry, University Dental Clinic in Zagreb, Croatia, using documentation on 447 patients (264 male and 183 female) aged 1-16 years with injuries to primary and permanent teeth between February 2010 and January 2014. Charts with incomplete medical information were excluded from analysis. Information from trauma charts was organized by age, gender, place and source of trauma, hour and season of trauma, interval between injury and treatment, number of traumatized teeth, injured teeth, type of trauma, and soft tissue injuries. Radiographs were also used to classify hard and periodontal tissue damage. The type of trauma was classified according to Andreasen and Andreasen<sup>14</sup> classification, as follows:

- injuries to the hard tissue and the pulp: enamel fracture, enamel-dentin fracture without pulp exposure, enamel-dentin fracture with pulp exposure, crown-root fracture, root fracture and alveolar fracture; and
- injuries to the periodontal tissue: concussion, subluxation, displacement, intrusion, extrusion and avulsion.

Soft tissue injuries were divided into upper and lower lip, tongue, gingival, and lip and gingiva injuries. Dental injuries of primary and permanent dentitions were analyzed separately in three age groups (1-6, 7-12, and 13-16). TDI was classified according to the most serious damage if a specific tooth had more than one type of injury.

Ethical approval for this study was obtained from the Ethics Committee of the School of Dental Medicine, University of Zagreb, Croatia.

Statistical analysis was performed using descriptive statistics and Pearson's  $\chi^2$ -test using Predictive Analytics software (PASW) for Windows version 17.0 (SPSS

Inc., Chicago, IL, USA). The level of significance was set at 5%.

## Results

Of the 447 patients attending the University Dental Clinic in Zagreb, there were 59.1% of male and 40.9% of female patients, yielding a 1.5:1 male to female ratio. Patient age ranged from 1 to 16 years (mean  $\pm$  SD = 8.2 $\pm$ 3.8 years). The highest prevalence of TDI was found in the 7- to 12-year age interval (Fig. 1). Trauma was seen in 217 primary and 542 permanent teeth, in total 759 analyzed teeth. Thus, the number of injured primary teeth was 1.69 *per* child, and the number of injured permanent teeth was 1.7 *per* child. The most frequently affected primary teeth were maxillary central incisors (81.1%), followed by maxillary lateral incisors (15.6%). The most frequently affected permanent teeth were maxillary central incisors (80.9%), followed by maxillary lateral incisors (11.9%). In both groups, the left side was more affected than the right side, and mandibular teeth were less affected than maxillary teeth.

The most commonly observed TDI of the dental hard tissue and pulp in both primary and permanent dentitions was enamel-dentin fracture without pulp exposure (31.9%), followed by enamel-dentin fracture with pulp exposure (18.2%) and enamel fracture (11.1%). Analyzing periodontal tissue injury in both types of dentition, subluxation was the most common type (27.3%). Far behind subluxation were avulsion (8.2%) and intrusion (8.0%). The types of dental and periodontal injuries were found to be highly signifi-

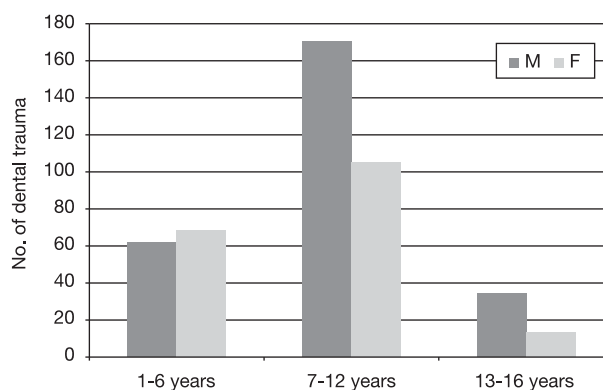


Fig. 1. Distribution of traumatic dental injuries according to age and gender.

Table 1. Distribution of trauma type according to age groups

		Injuries to hard dental tissue and pulp						Total
		Enamel fracture	ED fracture without pulp exposure	ED fracture with pulp exposure	Root fracture	Crown-root fracture	None	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Age (yrs)	1-6	9 (10.7)	24 (9.9)	21 (15.2)	3 (27.2)	5 (35.7)	155 (57.4)	217 (28.6)
	7-12	68 (81)	183 (75.6)	92 (66.7)	7 (63.7)	5 (35.7)	93 (34.4)	448 (59)
	13-16	7 (8.3)	35 (14.5)	25 (18.1)	1 (9.1)	4 (28.6)	22 (8.2)	94 (12.4)
Total		84 (100)	242 (100)	138 (100)	11 (100)	14 (100)	270 (100)	759 (100)
		Injuries to periodontal tissue						Total
		Subluxation	Intrusion	Extrusion	Avulsion	Displacement	None	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Age (yrs)	1-6	90 (43.5)	39 (63.9)	14 (35.9)	28 (45.2)	4 (36.3)	42 (11.1)	217 (28.6)
	7-12	96 (46.4)	18 (29.5)	22 (56.4)	27 (43.5)	5 (45.5)	280 (73.9)	448 (59)
	13-16	21 (10.1)	4 (6.6)	3 (7.7)	7 (11.3)	2 (18.2)	57 (15)	94 (12.4)
Total		207 (100)	61 (100)	39 (100)	62 (100)	11 (100)	379 (100)	759 (100)

ED = enamel-dentin

cantly associated with age ( $\chi^2=187.267$ ,  $\chi^2=127.659$ ,  $df=10$ ;  $p<0.001$ ) (Table 1).

Among different age groups, falls were the most frequent cause of TDI (52.1%: 35.6% at home, 24% at school and 15.6% in sports), followed by collisions with objects (17.9%: 33.7% in sports, 31.2% at school and 22.5% at home) and bicycle/rolling accidents (9.6%: 51.2% free time, 27.9% in sports and 18.6% at home). The rarest cause was violence (only 2%). Differences in the distribution of the location and cause of accidents were highly significant ( $p<0.001$ ).

Traumatic dental injuries occurred primarily in spring ( $n=123$ ; 27.5%), followed by autumn ( $n=121$ ; 27.1%), summer ( $n=104$ ; 23.3%) and winter ( $n=99$ ; 22.1%). Differences were observed in the distribution of seasonal accidents between the genders. Males were injured more often in autumn, and females were injured more often in spring ( $p<0.05$ ). The results also showed differences in the distribution between different age groups and seasons. Children aged 1-6 experienced TDIs in spring and summer (39 cases), whereas children aged 7-16 experienced TDIs in autumn (88 cases) ( $p<0.05$ ).

The majority of children with primary and permanent teeth had TDIs between 4 p.m. and 7 p.m.

Of the 447 patients that received treatment for TDIs, 203 (45.4%) also had soft tissue injuries. Distri-

bution of soft tissue injuries by gender (113 males and 80 females) was not statistically significant ( $p=0.351$ ). Of the overall number of patients with soft tissue injuries, 71 were preschoolers, and 132 were aged 7-16 years. The highest percentage of preschoolers had soft tissue injuries at the age of 2 (25.4%), and the highest percentage of school-age children had soft tissue injuries at the age of 9 (19.7%). Soft tissue injuries were less likely when a smaller number of teeth were traumatized ( $p<0.001$ ). Multiple dental injuries (2 teeth 66.7%, 3 teeth 17.4%, 4 teeth 12.1% and more than 4 teeth 3.8%) were found in 65% of the patients with soft tissue injuries, while 35% of patients had only one traumatized tooth. Of the total number of children, 25.7% had an injury to the upper lip, 9.8% had an injury to the upper lip and gingiva, 9.6% had injured gingiva, and only one patient (0.2%) had a tongue injury. Table 2 shows distribution of periodontal and dental hard tissue injuries to soft tissue injuries ( $p<0.001$ ).

The time elapsed between TDIs and initial treatment indicated that 33.6% of the children sought treatment within 1-7 days, and 28.9% sought treatment in 2-24 hours. In the group of children with an injured primary tooth, most of them (32%) received treatment within 2-24 hours, and 34.5% of the children with permanent teeth received treatment in 1-7

Table 2. Distribution of soft tissue injuries to hard and periodontal tissue injuries in both dentitions

Type of trauma	Soft tissue injuries				None	Total
	Upper lip	Tongue	Gingiva	Upper lip and gingiva		
Injuries to hard dental tissue and pulp	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Enamel fracture	27 (12.6)	0 (0.0)	7 (8.2)	7 (6.8)	43 (12.1)	84 (11.1)
ED fracture without pulp exposure	73 (33.9)	0 (0.0)	8 (9.4)	14 (13.6)	147 (41.5)	242 (31.9)
ED fracture with pulp exposure	53 (24.7)	2 (100)	1 (1.2)	12 (11.7)	70 (19.8)	138 (18.2)
Crown-root fracture	0 (0.0)	0 (0.0)	1 (1.2)	4 (3.9)	6 (1.7)	11 (1.4)
Root fracture	5 (2.3)	0 (0.0)	2 (2.4)	2 (1.9)	5 (1.4)	14 (1.8)
None	57 (26.5)	0 (0.0)	66 (77.6)	64 (62.1)	83 (23.5)	270 (35.6)
Total	215 (100)	2 (100)	85 (100)	103 (100)	354 (100)	759 (100)
Injuries to periodontal tissue	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Subluxation	63 (29.3)	0 (0.0)	32 (37.6)	43 (41.7)	69 (19.5)	207 (27.3)
Intrusion	18 (8.4)	0 (0.0)	5 (5.9)	13 (12.7)	25 (7.1)	61 (8)
Extrusion	12 (5.5)	0 (0.0)	5 (5.9)	11 (10.7)	11 (3.1)	39 (5.1)
Avulsion	4 (1.9)	0 (0.0)	34 (40)	18 (17.5)	6 (1.7)	62 (8.3)
Displacement	1 (0.5)	0 (0.0)	2 (2.4)	2 (1.9)	6 (1.7)	11 (1.4)
None	117 (54.4)	2 (100)	7 (8.2)	16 (15.5)	237 (66.9)	379 (49.9)
Total	215 (100)	2 (100)	85 (100)	103 (100)	354 (100)	759 (100)

ED = enamel-dentin

Table 3. Distribution of time elapsed between injury and treatment according to the presence of soft tissue injuries

Time elapsed	Primary teeth		Permanent teeth	
	Without STI	With STI	Without STI	With STI
	n (%)	n (%)	n (%)	n (%)
Up to 2 hours	1 (1.8)	13 (18.3)	17 (9.1)	19 (14.4)
2-24 hours	14 (24.6)	27 (38)	39 (20.9)	49 (37.1)
1-7 days	20 (35)	20 (28.2)	67 (35.8)	43 (32.6)
8-30 days	11 (19.3)	3 (4.2)	17 (9.1)	16 (12.1)
>31 days	11 (19.3)	8 (11.3)	47 (25.1)	5 (3.8)
Total	57 (100)	71 (100)	187 (100)	132 (100)

STI = soft tissue injuries

days. Data on the time elapsed changed when soft tissue injuries were included. Comparison of children with and without soft tissue injuries yielded a statistically significant difference in the time to arrival between primary and permanent teeth ( $p < 0.01$ ) (Table 3).

## Discussion

This research was conducted because there are no data on previous studies of dental trauma to primary and permanent teeth and soft tissue injuries in Croatia. The only published study similar to the present one was conducted on permanent teeth in the town of Rijeka<sup>15</sup> at the end of the last decade. Our research was conducted in the Croatian capital, at the Zagreb University Dental Clinic, which, in combination with its surroundings, represents approximately one-quarter of the Croatian population.

Although Glendor<sup>11</sup> states that there is a trend toward reduced gender differences in the distribution of trauma, as confirmed by other studies<sup>16,17</sup>, our study belongs to the group of studies<sup>18-20</sup> demonstrating that gender differences persist in favor of males (1.5:1). However, in this study, preschool girls showed higher rates of TDI than boys, which is in agreement with Carvalho *et al.*<sup>21</sup>. The reason for this finding may be that both boys and girls aged 1-6 are exposed to similar risk factors, and there is no difference between the games and sports they play. In contrast, school-aged



boys are more prone to risky behavior, a lack of discipline, fighting and sports than school-aged girls.

The findings of our study indicated that injuries occurred most often in children aged 7-12, supporting the findings of other authors<sup>8,18,22</sup>. The peak of injuries to primary teeth occurs at the age of 2 and at the age of 9 for permanent teeth. Our findings disagree with the studies by Osuji<sup>23</sup> and Eyuboglu *et al.*<sup>20</sup>, but are consistent with the study by Andreasen *et al.*<sup>24</sup>.

A lack of motor coordination<sup>25,26</sup> on walking and running is the main reason for TDI in preschool children, whereas in early school-age children, TDIs are most likely due to increased independence at school, playgrounds and sports<sup>4,27,28</sup>.

In agreement with previous studies<sup>18-20,29,30</sup>, this study showed that TDI commonly involved maxillary incisors. This finding may be explained by the fact that these teeth may have inadequate lip coverage and frequently protrude<sup>30</sup>. Furthermore, this study showed a statistically significant difference between the right and left side in favor of the latter. In the reviewed literature, this finding is in agreement only with Caldas and Burgos<sup>31</sup>.

The most common type of trauma in primary teeth was subluxation. Periodontal tissue injuries in primary dentition occurred 2.8 times more often than hard dental tissue injuries, a result similar to other studies<sup>3,16,20,28,32</sup>. This finding can be explained by the periodontal ligament elasticity and alveolar bone resilience<sup>26,30</sup>. In permanent teeth, enamel-dentin fractures without pulp exposure were the most frequent type of injury, which is similar to other studies<sup>12,15,18-20,33</sup>, but contrary to a group of studies that found enamel fracture to be the most frequent type of hard dental tissue injury<sup>34-37</sup>.

In this study, there was a statistically significant relationship between age, gender, location, and cause of injury ( $p < 0.05$ ). Consistent with the results of other studies, the most frequent cause of trauma was fall in both genders and in both primary and permanent teeth<sup>17,20,30,38</sup>. Regarding the location of TDIs, this study found that most injuries occurred at home in children aged 1-6 and at school in children aged 7-12, which is similar to previous studies<sup>18,25,39</sup>. The group of children aged 13-16 sustained TDIs during their free time, in contrast to similar studies<sup>18</sup>. This finding may be explained by the fact that in our study, all accidents in streets and public playfields were recorded as 'free

time' injuries, and children of that age spend the majority of their time as free time. Moreover, our city has a deficit of public playfields, and the existing ones have inadequate safety standards.

A few groups of authors<sup>38,40-42</sup> have reported that the frequency of TDI increases in warm months in comparison with cold months. Our finding that traumas to deciduous teeth occurred in spring and summer months is in agreement with these reports. However, our findings showed the highest frequency of TDI to permanent teeth in autumn, which may be related to the beginning of academic year.

Our results also confirmed the findings of other studies<sup>43,44</sup> that the majority of affected patients were treated more than 24 hours after accidents. However, the results on the time elapsed between sustaining the injury and receiving dental treatment for primary teeth were higher than in other studies due to incorrect routines by general practitioners in Zagreb. After a trauma, the patient first goes to his general practitioner, who, rather than treating the TDI, refers the patient to the University Dental Clinic. This results in an unnecessary waste of time and increases the likelihood of post-traumatic complications. Because of this situation, 42.9% of the patients sought treatment within 24 hours, in comparison to the figure of 62.8% reported by Choi *et al.*<sup>29</sup>.

The literature reports a wide range of incidence of oral soft tissue injuries, from 14%<sup>19,45</sup> to nearly half of all dental traumas<sup>12,13</sup>. Our finding was 45.4%. The literature shows that the prevalence of soft tissue injuries in association with injuries to the primary teeth was 45.2%<sup>29</sup>, which is fewer than in our study (55.5%). The same information was not found for permanent teeth, whereas the finding in the present study was 41.4%.

Patients with combined TDI and oral soft tissue injuries to primary and permanent teeth sought treatment sooner than patients without oral soft tissue injury. This finding is in agreement with previous reports<sup>16,18,29</sup>. The more urgent dental treatment is the result of bleeding tendencies and edema caused by soft tissue damage. Furthermore, the disturbing clinical appearance of the child tends to make parents more anxious and motivates earlier dental treatment.

The prevalence of soft tissue injuries in studies should be considered with caution because this information may not be noted for children seeking help after two weeks (in this study, 84 patients). Fehrenbach

*et al.*<sup>46</sup> state that mucosa and skin injuries can heal in approximately two weeks.

In conclusion, this study showed that males sustained TDI 1.5 times more often than females. The maxillary central incisors were the most affected teeth in the primary and permanent dentitions. The most common TDI of hard dental and pulp tissue was enamel-dentin fracture without pulp exposure, and the most common type of periodontal tissue injury was subluxation followed by avulsion and intrusion. Regarding the location of dental trauma, this study showed that the main cause was fall. These results are similar to the results of other studies. However, the place of sustaining trauma was related to the age of the child. Thus, TDI tended to occur at home in children younger than 6, at school in those aged 7-12, and in free time in those aged 13-16 years.

Nearly half of all patients had soft tissue injuries together with dental injuries, and these injuries were more likely when a larger number of teeth were traumatized. Because soft tissue injuries include bleeding and clinical presentation appears more dramatic, the time elapsed between the injury and initial treatment was shorter than in non-bleeding injuries. This finding points to the need of education focused on parents and school teachers regarding the importance of immediate therapy for both bleeding and non-bleeding TDIs. Every unnecessary time delay increases the expense and complications of treatment.

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## Sažetak

## UČESTALOST, VRSTA I ETIOLOGIJA DENTALNIH I MEKOTKIVNIH OZLJEDA KOD DJECE U HRVATSKOJ

*J. Škaričić, M. Vuletić, S. Hrvatinić, J. Jelčić, I. Čuković-Bagić i H. Jurić*

Svrha ovoga istraživanja je bila istražiti učestalost, vrstu i etiologiju dentalnih ozljeda te ozljeda mekih tkiva. Također se ispitala korelacija vremena proteklog između ozljede i potražene pomoći kada su bile prisutne i ozljede mekih tkiva. Retrospektivno istraživanje je provedeno na Zavodu za dječju stomatologiju Stomatološkog fakulteta Sveučilišta u Zagrebu u razdoblju od 2010. do 2014. godine koristeći dokumentaciju 447 pacijenata u dobi od 1-16 godina (264 dječčaka i 183 djevojčice) s ozljedama mliječnih i trajnih zubi. Najveća učestalost traumatskih dentalnih ozljeda je pronađena u dobnoj skupini od 7 do 12 godina, a gornji središnji sjekutići (80,9%) su bili najčešće zahvaćeni zubi u obje denticije. Fraktura cakline i dentina bez izlaganja pulpe (31,9%) bila je najčešća vrsta ozljede kod tvrdog zubnog tkiva u obje denticije, dok je subluksacija (27,3%) bila najčešća vrsta ozljede parodontnog tkiva. Najčešća lokacija, uzrok i godišnje doba traume su bile kod kuće, pad i proljeće. Ozljede mekih tkiva su pronađene kod 203 (45,4%) pacijenata i bile su češće kod pacijenata koji su imali više traumom zahvaćenih zubi ( $p < 0,001$ ). Uspoređujući pacijente s ozljedama mekih tkiva i one bez njih statistički značajna razlika pronađena je u vremenu proteklom do potražene stručne pomoći između mliječnih i trajnih zuba ( $p < 0,01$ ). Zbog toga što ozljede mekih tkiva često uključuju krvarenje cijela klinička slika izgleda mnogo dramatičnije, vrijeme proteklo između ozljede i početnog liječenja bilo je kraće od onoga za ozljede koje nisu uključivale ozljedu mekih tkiva. To pokazuje potrebu za ciljanim obrazovanjem roditelja i učitelja o važnosti neposredne terapije dentalnih ozljeda kao i ozljeda mekih tkiva.

Ključne riječi: *Zub, mliječni; Zub, trajni; Zub, ozljede; Meko tkivo, ozljede*