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# Orofacial damage resulting from road accidents

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**Abstract** – The objective of this paper was to study the epidemiological characteristics of orofacial damage resulting from road accidents among victims assessed in the Oporto delegation of the Legal Medicine Institute, in Portugal. It was also our goal to analyze in which way orofacial sequelae was reflected in the victims' complete social reintegration.

Orofacial traumatic injuries are a common problem and several studies have reported that the prevalence of these injuries has increased during the past few decades (1–7). These injuries can take place in many different situations, with road accidents being the most frequent cause (8). However, because of the severity of many road injuries, orofacial injuries can be regarded as minor. Nevertheless, later they can create serious sequelae, which may prevent some orofacial functions, impairing social life, disturbing relationships or even have a negative effect on one's professional activity. In Portugal, all road accident victims are required to register in a Legal Medicine Institute, to evaluate any resulting sequelae. A forensic examination is carried out and a report is made when the victims are stable.

The aim of this work was to investigate the epidemiological characteristics of orofacial damage among road accident victims, studying their sequelae nature based on a three-dimensional body damage assessment: body, capacities and life situations.

## Material and methods

This study was carried out on all road accident reports concerning forensic examinations done in the Oporto delegation of the Legal Medicine Institute, between January 1998 and December 2002, based on the current legislation. Of these, the final reports (i.e. with stable injuries only) which referred to orofacial trauma ($n$ = 108) were selected. These records were reviewed and analyzed according to the nature of orofacial injuries and their consequences (sequelae), age and gender distribution, employment status, road accident type and severity of global injuries.

To analyze orofacial injuries, the anatomical location of the injury was identified and its nature as well. If the same area sustained more than one kind of injury, only the most severe was registered.

As the final forensic report is made only when the victims are stable, it was possible to collect data concerning the consequences of the injuries suffered. These consequences, or sequelae, were assessed considering their organic, functional and situational impact, as performed previously using the 'Body Damage Assessment Inventory'(9). To study orofacial sequelae impact, a four-level scale was used (Table 1).

SPSS 11.5 software (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. Pearsons' chi-squared ($\chi^2$) test was used to compare qualitative data and determine the statistical significance. The level of statistical significance was set at $P < 0.05$.

## Results

During a period of 4 years, among 693 reports of road accident victims, orofacial trauma was referred to in 108 (15.6%).

### Age, gender, employment status and road accident type

Most victims were males (69.4%) and their ages ranged from 5–69 years, with a mean age of 32.37 years

*Table 1.* Functional and situational sequelae severity scale

| Grade | |
|---|---|
| 0 | No difficulties |
| 1 | Minimal difficulties (slowness, discomfort) |
| 2 | Medium difficulties (technical or medical aids) |
| 3 | Important difficulties (partial human aid) |
| 4 | Impossibility (total human aid) |

(SD = 12.90). The majority of victims were employed before the injury (94.4%) and in more than 50% of the cases ($n$ = 63), the employment was related to industry, agriculture, fishing and commercial activities. The largest proportion of road accidents involved four wheelers (55.2%), followed by motorcycles (28.6%) and pedestrians (16.2%).

#### Injuries

Regarding the severity of global injuries, 43.6% of the sustained injuries were considered severe (grade 3 or 4) (Table 1), with the face being the second anatomical location sustaining the most severe injury (30.6%; $n$ = 33); however, none of those were potentially life threatening (Table 2).

The same person could present multiple injuries, therefore, there were a higher number of injuries ($n$ = 207) than the number of people with injuries ($n$ = 108). The distribution of orofacial injuries (Fig. 1) was: soft facial tissues (37.7%), teeth and periodontal tissues (22.7%), upper and lower jaw (17.9%), lips (15.9%), tongue (3.4%), and gingival and oral tissues (2.4%). The type of injury suffered depended on the location of the injury, as shown in Table 3. According to injury severity, the jaw area was the one which received the most serious injuries (fractures).

#### Body sequelae

Body sequelae were present in 92.6% ($n$ = 100) of the selected reports. As the same person could present multiple sequelae, the total number of body sequelae was greater than the number of people with sequela ($n$ = 194). The distribution of body sequelae was (Fig. 2): soft facial tissues (38.6%), teeth and periodontal tissues (23.2%), lips (12.9%), temporo-mandibular joint (TMJ) (9.3%), upper and lower jaw (5.7%), nerves (excluding facial nerve and lingual nerve) (5.7%), gingival and oral mucosal tissues (2.1%), tongue (1.5%), and facial nerve and lingual nerve (1.0%). The nature of body sequelae are shown in Table 4.

*Table 2.* Most severe injury location ($n$ = 108)

| | Severity | | | | |
|---|---|---|---|---|---|
| Location | Grade 1 | Grade 2 | Grade 3 | Grade 4 | Total ($n$; %) |
| Skull and (or) neck | 1 | 10 | 1 | 8 | 20; 18.5% |
| Face | 8 | 15 | 13 | 0 | 36; 33.3% |
| Spinal cord | 0 | 0 | 0 | 1 | 1; 0.9% |
| Tórax and (or) abdomen | 1 | 4 | 3 | 5 | 13; 12.0% |
| Limbs | 1 | 18 | 17 | 2 | 38; 35.2% |
| Total | 11 (10.2%) | 47 (43.5%) | 34 (31.5%) | 16 (14.8%) | 108; 100% |

Grade 1: superficial injuries only; grade 2: injuries that, although not being superficial, do not require surgical treatment; grade 3: injuries not life-threatening, requiring surgical treatment; grade 4: life-threatening injuries.

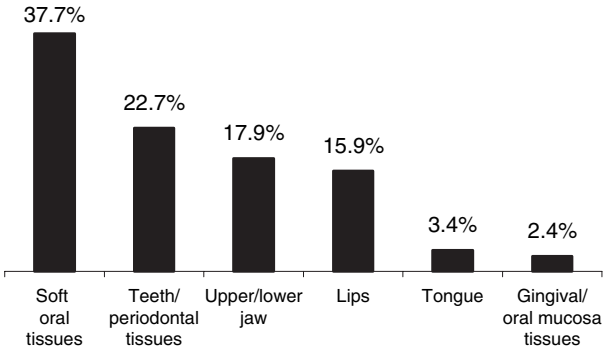


*Fig. 1.* Orofacial injuries location ($n$ = 207).

*Table 3.* Orofacial injuries type ($n$ = 207)

| Location | Injury type | % |
|---|---|---|
| Soft facial tissues | Lacerations | 97.4 |
| | Contusions | 2.6 |
| Upper and (or) lower jaw | Lower jaw fractures | 47.4 |
| | Upper jaw fractures | 28.9 |
| | Upper and lower jaw fractures | 23.7 |
| Teeth and periodontal tissues | Fractures | 87.2 |
| | Luxations | 10.6 |
| | Avulsions | 2.2 |
| Lips | Lacerations | 100 |
| Tongue | Lacerations | 100 |
| Gingival and (or) oral mucosa tissues | Lacerations | 100 |

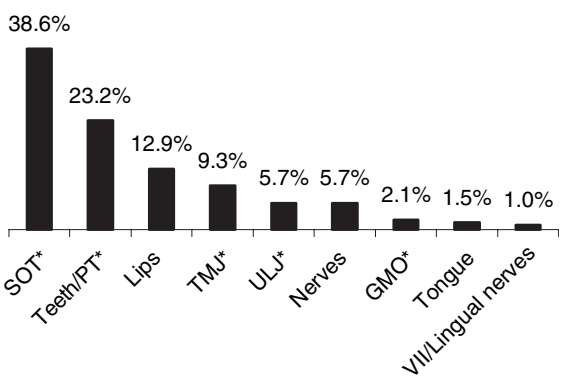


*Fig. 2.* Orofacial organic sequelae location ($n$ = 194).

#### Functional sequelae

Functional sequelae were present in 30.6% ($n$ = 33) of the selected reports. Occasionally, several functions were

*Table 4*. Organic orofacial sequelae type ($n$ = 161)

| Location | Orofacial sequelae type | % |
|---|---|---|
| Soft oral tissues | Less then 2 cm length scar | 18.7 |
| | 2–5 cm scar | 40 |
| | More then 5 cm length scar | 41.3 |
| Teeth and/or periodontal tissues | Missing tooth | 46.7 |
| | Prosthetic replacement | 31.1 |
| | Restoration | 13.3 |
| | Dental structure loss | 8.9 |
| Lips | Scar | 100 |
| Temporo-mandibular joint | Maximum mouth opening limitation | 100 |
| Upper and/or lower jaw | Upper jaw dismorphy | 63.6 |
| | Lower jaw dismorphy | 27.3 |
| | Upper and lower jaw dismorphy | 9.1 |
| Other nerves | Lower lip sensitivity loss | 90.9 |
| | Upper lip sensitivity loss | 9.1 |
| Gingival and/or oral mucosa tissues | Scar | 75 |
| | Gingival recession | 25 |
| Tongue | Scar | 100 |
| Facial and/or lingual nerves | Unilateral facial palsy | 50 |
| | Partial tongue sensitivity loss | 50 |

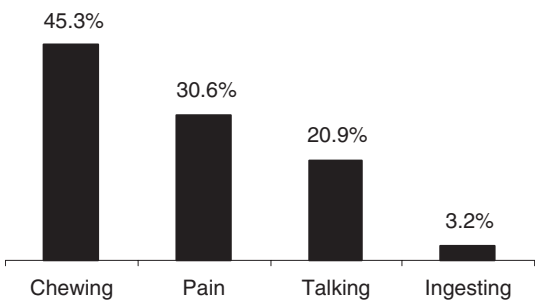


*Fig. 3*. Orofacial functional sequelae type ($n$ = 62).

*Table 5*. Functional orofacial sequelae type ($n$ = 62)

| Function | Functional sequelae type | % |
|---|---|---|
| Chewing | Painful and/or difficult chewing | 85.7 |
| | Chewing requires technical aids | 14.3 |
| Feeling pain | Mild pain | 63.2 |
| | Medium pain | 36.8 |
| Talking | Slowness or with difficulties | 100 |
| Ingesting | Slowness or with difficulties | 100 |

impaired or diminished, with the total number of 62 functional sequelae. Functional sequelae were (Fig. 3): chewing problems (45.3%), existence of pain (30.6%), speech difficulties (20.9%) and ingestion problems (3.2%). Chewing problems were described more frequently as chewing difficulties or painful chewing (85.7%) (Table 5). Pain existence was mostly encountered in the lower jaw (63.2%), followed by the upper jaw (21.1%), head or face (10.5%) and teeth (5.3%).

#### Situational sequelae

Situational sequelae were present in 64.8% of the cases ($n$ = 70) (Fig. 4) and were related with: social life (56.5%), daily diet (29.6%), daily life (13.9%) and professional activities (12.0%). These sequelae were found to be mostly mild (Table 6).

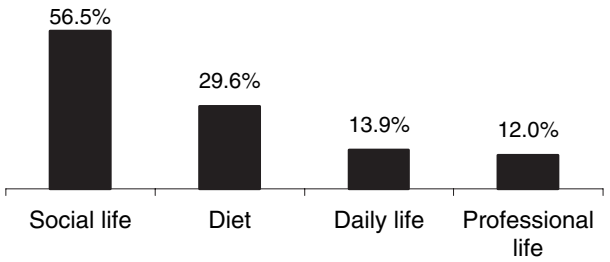


*Fig. 4*. Orofacial situational sequelae ($n$ = 70).

*Table 6*. Situational sequelae severity ($n$ = 70)

| | Sequelae type (%) | | | |
|---|---|---|---|---|
| Severity | Social life | Diet | Daily life activities | Professional life |
| Mild | 77 | 59.4 | 80 | 69.2 |
| Medium | 23 | 40.6 | 20 | 30.8 |

#### Relation among body, functional and situational sequelae

Dental and periodontal sequelae were significantly associated with some functional [chewing problems ($P$ = 0.018) and speech difficulties ($P$ = 0.006)] and some situational sequelae [mild or moderate diet changes ($P$ = 0.01)]. TMJ sequelae were significantly related with sequelae concerning chewing, talking and pain (Table 7), and with every situational sequelae (Table 8). Lip sequelae were related with social life alterations ($P$ = 0.00). Daily diet changes were significantly associated with: chewing problems ($P$ = 0.00), ingestion problems ($P$ = 0.028), speech difficulties ($P$ = 0.00) and the existence of pain ($P$ = 0.00). Changes in daily life activities were significantly related with chewing and speech problems ($P$ = 0.00 and $P$ = 0.00), and with the

*Table 7*. Relationship between TMJ and functional sequelae

| Function | Sequelae type | % | *n* | *P* |
|---|---|---|---|---|
| Chewing | Painful and/or difficult chewing | 61.1 | 11 | 0.000 |
| Talking | Slowness or with difficulties | 33.3 | 6 | 0.002 |
| Pain | Feeling pain | 66.7 | 12 | 0.000 |

*Table 8*. Relationship between TMJ and situational sequelae

| | Social life | Diet | Daily life activities | Professional life |
|---|---|---|---|---|
| % | 77.8 | 83.3 | 44.4 | 44.4 |
| *n* | 14 | 15 | 8 | 8 |
| *P* | 0.04 | 0.00 | 0.00 | 0.00 |

existence of pain ($P = 0.00$); changes in social life activities were significantly related with speech problems ($P = 0.00$).

#### Elapsed time between trauma and the final report

The elapsed time between trauma and the final report ranged from 0.11–8.75 years, with a mean time of 4.05 (SD = 2.87) and no relationship was found between time elapsed and organic, functional or situational sequelae.

#### Corporal damage items

Corporal damage items assessed in the forensic reports were: disability (temporary and permanent, general and professional), *quantum doloris* and esthetical damage (or disfigurement). These items are described in Table 9. Forensic reports referring to orofacial damage alone represent only 11.1% of the total number of cases studied ($n = 12$), and are described in Table 10.

## Discussion

Orofacial damage is fairly common in accident-related trauma (8–13). Although our study noted a 15.6% prevalence, many orofacial injuries in road accidents might be unnoticed because of: the presence of other more serious injuries, the difficulty of a prompt diagnosis associated with some injuries [for example, diagnosing vertical root fractures (9, 14, 15)] and the lack of emergency room clinical records referring to orofacial injuries suffered (16). Also, the medium time elapsed between the traumatic event and the last evaluation exam can prevent the correct complaint assessment and physical examination, because as time goes by, other traumatic or pathological events can occur. Nevertheless, our results showed important long-term consequences of the diagnosed orofacial injuries. The use of forensic reports to collect data allowed this long-term assessment and also the possibility to evaluate the consequences of orofacial injuries based on a three-dimensional body damage assessment: body, capacities and life situations.

*Table 9*. Corporal damage items assessment ($n = 108$)

| | Temporary | | | Permanent | | |
|---|---|---|---|---|---|---|
| Consequences | GTTD[1] | GTPD[2] | QD[3] | GPD[4] | PPD[5] | ED[6] |
| Maximum | 1584 | 1280 | 7 | 100% | 100% | 5 |
| Minimal | 0 | 8 | 1 | 0 | 0 | 0 |
| Average | 112.93 | 219.54 | 4.17 | 20.5% | 26.1% | 2.23 |
| Standard deviation | 195.66 | 212.83 | 1.077 | 28.7% | 17.5% | 1.24 |

[1]GTTD – general temporary total disability period refers to those days in which a person cannot live an independent daily, social, familial and professional life. Usually, it refers to the time spent in hospital or at home, in total rest.
[2]GTPD – general temporary partial disability period refers to those days in which a person can, with some limitations, live an independent daily, social, familial and professional life.
[3]QD – *quantum doloris*, refers to the physical and psychological pain felt during the temporary disability period.
[4]GPD – general permanent disability refers to the permanent damage of a person's physical or pshychological integrity, considering his (or hers) daily, social, familial and professional life activities.
[5]PPD – permanent professional disability refers to the permanent damage of a person's physical or pshychological integrity, considering his (or hers) professional life activities.
[6]ED – esthetical damage reflects, in a static and dynamic way, the suffered sequelae, accounting for one self-image and people normal interaction.

*Table 10*. Corporal damage items assessment in orofacial damage alone cases ($n = 12$)

| | Temporary | | | Permanent | | |
|---|---|---|---|---|---|---|
| Consequences | GTTD | GTPD | QD | GPD | PPD | ED |
| Maximum | 385 | 385 | 7 | 27% | 27% | 4 |
| Minimal | 2 | 10 | 1 | 0% | 0% | 0 |
| Average | 58.6 | 123.5 | 3.45 | 9.4% | 10.3% | 1.64 |
| Standard deviation | 117.25 | 136.205 | 1635 | 8.3% | 10.1% | 1.20 |

#### Injuries

This study revealed a prevalence of 37.7% for soft oral tissue injuries, making these the most prevalent. This rate is coupled with epidemiologic data in current literature (17–19). With respect to teeth and periodontal tissue injuries, the current study contrasts with others [22.7% in the current study compared with 42.8% (18), 49.9% (20) and 50.8% (21)] in the literature. However, these studies focus either on orofacial traumatic injuries regardless of their aetiology (18, 20) or on a specific type of road accidents causing orofacial injuries (21). Besides, in this study has taken into consideration injuries that other studies have not (such as tongue or gingival and oral mucosal injuries). In the jaw area, this study revealed a prevalence of 17.9%, making this area the third most prevalent site of orofacial injury. Epidemiologic data in current literature refer to road accidents as the first (22, 23) or second (24) cause of maxillofacial fractures. In this study, isolated lower fractures were almost twice as frequent as isolated upper jaw fractures. These findings corroborated previous reports regarding certain epidemiological characteristics of maxillar and mandibular fractures (22, 23, 25). The mobility of the lower jaw and the fact that it has less bony support than the maxilla might explain these results. With respect to lips, tongue, gingival and oral mucosal injuries, we have found it difficult to compare our results with data in the current literature. We believe this underlines the need for further studies in this area.

#### Sequelae

We have found it difficult to compare our data with other studies, because the majority of studies focus on maxillofacial injuries (17, 19–23, 25) and not on their sequelae. We have found, however, on exception: Gassner et al.(18), in 2003, assessed orofacial injuries and reported at the long-term follow up, disability problems related to visual problems, alterations in smell, difficulty with mastication and breathing, and epiphora, preventing employment (18). According to our study, orofacial injuries can have several long-term consequences. For instance, we found a prevalence of 38.6% for soft oral

tissue sequelae in all body sequelae ($n = 194$), which can have both functional and aesthetic consequences. Dental and periodontal sequelae were the second most prevalent body sequelae, with missing teeth being the permanent organic consequence more often identified. This result shows that teeth fracture (as the most prevalent dental injuries) are not taken seriously and the direct implication of this finding is the extraction of the fractured teeth. However, the analysis of the forensic reports did not allow us to determine the type of dental fracture injuries suffered and it is known that the specific type of dental fracture is a determining factor for teeth prognosis. For instance, tooth root fractures are very common (26). If they concern the third apical root, the tooth can be treated removing the fractured tooth fragment. However, if the fracture line affects the middle or third cervical root, it is often difficult to save the affected tooth (10).

In this study, lip lacerations were the only injuries identified in the lip area with their consequences being the formation of scar tissue. However, when considering the nerve area sequelae, we found nine cases with loss of one lip sensibility. According to our study, these sequelae caused great functional hazards such as talking and ingesting food. Gingival and oral mucosa tissue sequelae were scar tissue formation or gingival recession. According to current literature, these sequelae can cause dental hypersensitivity, aesthetic problems or both (27). Because of its location, the tongue was also frequently injured (28). Yet, in our study, the tongue is the second least harmed anatomical area, probably due to the lack of appreciation of tongue injuries suffered. Tongue sequelae were scar tissue formation (three cases) and partial loss of sensibility (one case). Regarding this last case, it should be pointed out that partial loss of sensibility to the tongue led to functional impairment, especially when considering chewing and talking.

Considering functional sequelae, our study indicated to chewing difficulties as the most frequent. Talking was also often affected, which is consistent with other study data (29). Every sequelae had more or less a severe impact on the individuals life, until the social life being the most frequently affected area. According to several authors, this might be explained as functional impairment, changes in diet and also by the aesthetic changes suffered (30, 31). Pain and functional impairment, as a result of temporo-mandibular disorders, also affected the victim's social, familial, emotional and professional activities. It should be pointed out that temporo-mandibular disorders can occur not only because of blunt force trauma, but also as a consequence of the emotional stress usually surrounding these events (32, 33).

#### Corporal damage item assessment

Again, we were not able to compare our data with any study because the majority of studies in this area refer to global corporal damage assessment and not to orofacial damage assessment. We believe more studies are needed to reach more definitive conclusions. Yet, based on our data, we found that orofacial damage alone involves fewer corporal damage items, representing a lower disability period, with fewer permanent consequences with a lesser socioeconomic impact in terms of workdays lost and decreased productivity. The emotional impact and possible long-term disfigurement were also lower.

## Conclusions

The results that have been achieved in our study show that road accidents play a significant role in orofacial injuries. Orofacial injuries were present in 15.6% of all road accidents. These injuries can have long-term consequences, seriously impairing a person's life. Yet, more studies are needed to fully understand the long-term consequences of orofacial injuries in road accidents.

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