A55 Fracture Pattern of Midface Ballistic Trauma

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Learning Overview: After attending this presentation, attendees will be aware of midface fracture patterns that may assist in differentiating intraoral from submental gunshot wounds.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by contributing to the research on gunshot wounds to the midface that have direct implications for dry bone analysis.

Gunshot injury signatures (i.e., entrance and exit wound) can often be diagnosed and interpreted at autopsy when soft tissue is present. In the absence of soft tissue, fracture patterns of the hard tissue may be interpreted; however, there is limited information regarding skeletal fracture patterning resulting from intraoral versus submandibular gunshot wounds. In 2005, Fenton et al. reported on five skeletal cases with self-inflicted gunshot wounds to the midline of the skull.[1] They identified a possible diagnostic pattern of bilateral fracturing that occurs as a result of shotgun, rifle, and handgun injuries. The limitation of the 2005 study was that it addressed only five cases, with different firearms: two intraoral rifle, two submandibular or possible submandibular shotgun, and one mid-frontal pistol. The purpose of the current research is to build upon the 2005 study by examining a focal region of the skull; (i.e., the palate; and mandible) of a larger study sample to identify possible distinguishing patterns between intraoral and submandibular gunshot wounds.

This study is a retrospective exploratory investigation of suicides in which a handgun was positioned either intraorally or submentally. The mandible and palate are the skeletal emphases since these are the main points of entry for these types of gunshot wounds. Additionally, this study addresses the relationship of the chambering of the firearm/projectile caliber to the injury pattern. The study sample comprised 187 suicides by intraoral or submental gunshot wounds autopsied from 2010–2019 by the Harris County Institute of Forensic Sciences in Houston, TX. These data were collected by reviewing radiographs, autopsy photographs, and autopsy reports for the presence or absence of a mandibular fracture and/or palate impact. Projectile caliber size was available for all but four cases. The variables investigated were palate impact, the location of the mandibular fracture (anterior, posterior, or both), and the projectile caliber. Logistic regression models were used to identify the relationships between the presence/absence of a mandibular fracture, palate impact, and location of mandibular fractures in relation to the point of entry (submental and intraoral wound). Pearson's chi-square test was used to evaluate the relationship between the presence of mandibular fractures and projectile caliber.

Of the 187 cases, 19 (10%) were submental and 168 (90%) were intraoral. Sixteen of the 19 submental cases (84%) displayed a mandibular fracture, while 31 of the 168 intraoral cases (18%) displayed a mandibular fracture. Of the 19 submental cases, 8 (42%) displayed only an anterior mandibular fracture, zero displayed only a posterior fracture, and 7 (37%) displayed both anterior and posterior fractures. Of the 168 intraoral cases, there were 26 (3.5%) with an anterior fracture, 4 (2.3%) with a posterior mandibular fracture, and 2 with simultaneous anterior and posterior mandibular fractures. Finally, palate impacts were identified in 18 of the 19 submental cases, and 132 of 168 intraoral cases.

The logistic regression model demonstrated that for submental entries, the odds of observing mandibular fractures were significantly greater than not observing mandibular fractures (OR=24.04, 95% CI [6.53, 88.52]; p<0.001). In addition, palate impacts were not a significant predictor of point of entry (p>0.05). Mandibular fracture location was statistically significant for submental entries (p<0.001), and the odds of observing simultaneous anterior and posterior fractures for submental entries was between 10 and 11 times greater than observing anterior and posterior in isolation. Chi-square analysis indicated there was no significant relationship between projectile caliber and the presence of a mandibular fracture (p>0.05).

The results of this study are promising for identifying skeletal fracture patterns that may differentiate between intraoral and submental gunshot wounds. One study limitation is the small submental sample size. A larger sample size may provide additional statistical support for interpreting intraoral versus submental gunshot wounds based on mandibular fracture patterns. Future prospective studies—via autopsy and/or Computed Tomography (CT) scanning—should explore the fracture patterning of the entire skull using known cases of intraoral and submental gunshot wounds.

Reference(s):

1. Fenton, Todd W., Vincent H. Stefan, Leslie A. Wood, and Norman J. Sauer. Symmetrical Fracturing of the Skull from Midline Contact Gunshot Wounds: Reconstruction of Individual Death Histories from Skeletonized Human Remains. *Journal of Forensic Sciences*. 50, no.2 (2005): 1-12.

Forensic Anthropology, Gunshot Trauma, Trauma Analysis

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