Craniofacial Fracture Patterns

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Abstract

Craniofacial fracture patterns were investigated in hospitalized patients and fatally injured subjects to determine the influence of helmets, spectacles, and dentures. Standardized clinical and radiographic assessment techniques were developed and fracture patterns were recorded at operation or necropsy. All fracture data were encoded into an alpha-numerical system for analysis.

From the hospitalized group interesting associations emerged of naso-ethmoidal fracturing with spectacle wearing and maxillary fracturing with denture wearing. Hospitalized motorcyclists who had worn open-face helmets, or full-face helmets with flexible face-bars, had sustained facial fracturing but minimal brain injury. In contrast, motorcyclists killed from anterior craniofacial impact whilst wearing full-face helmets with rigid face-bars had sustained fatal skull base fracturing in the absence of significant facial trauma.

It was therefore postulated that impacts to the face-bar of a full-face helmet may be transmitted through the mandibular rami and mandibular condyles to the skull base with subsequent fracturing of the middle cranial fossa, the integrity of the mid-facial skeleton being preserved.

Helmet deformation patterns, as delineated by computed tomography, provided support for the proposed mechanism of energy transfer to the skull base. Independent neuropathological examinations of the brains of the fatally injured motorcyclists revealed a high incidence of

ponto-medullary disruption. This further strengthened the postulate because separation of the robust pons from the slender medulla may result from axial traction imparted to the brainstem by an upward fracturing middle cranial fossa shelf. Futhermore the skull base fractures traversed the mid-line through, or near to, the spheno-occipital synchondrosis which has an heterogenous morphology and is part of a potential 'fault line' across the skull base. That such a skull base fracture can occur from upward impaction of the skull base by column loading of the mandibular ramus has been noted in reports of judicial hangings in which the knot was placed beneath the mandibular angle.

From this study it was concluded that objects worn at impact on the craniofacial region may influence significantly the final craniofacial fracture pattern and this may be detrimental for some motorcyclists wearing full-face helmets.