Degloving Injuries of the Oral Cavity Change the Operative Approach to Fractures of the Anterior Segment of the Mandible

Richard A. Pollock, M.D.,¹ Katherine M. Huber, B.S.,³
and Joseph E. Van Sickels, D.D.S.²

ABSTRACT

No report to date describes the added risk traumatic, degloving injuries of the oral cavity may pose when treating fractures of the mandible. The authors describe the oral degloving injury, characterized by separation of periosteum and soft tissue of the anterior floor of the mouth from the inner cortex of the anterior segment. Vascular anatomy of the floor of the mouth is reviewed as a prelude to a description of pathomechanics of the injury and a case report. The higher incidence of oral degloving in youth and in young adulthood and parallels in elective, orthognathic surgery are identified. When this unusual clinical presentation occurs, and when *open* reduction of fractures of the anterior segment is chosen, a vestibular incision is best avoided. Instead, a submental or upper neck incision is chosen for sufficient exposure to allow reduction and the application of appliances. Meticulous closure of the intraoral void is achieved using one of two techniques, depending on the level of degloving.

KEYWORDS: Degloving, oral cavity, mandible

Repair of fractures of the anterior segment of the mandible today is successful in most cases, when (1) attention to details of rigid fixation and infusion of perioperative antibiotics are achieved, and (2) meticulous, postoperative hygiene is pursued. Fractures are routinely approached by way of an incision in the lower vestibule or upper neck without fear of vascular compromise, despite presumed disruption of the endosteal supply in the zone of bone injury.

Contusion of the lip or chin, concurrent injury to buccal periosteal blood supply, and even degloving of the *outer* cortex, when present, are seldom a major concern toward a successful outcome. Viability of the inner cortex is assured, awaiting reestablishment of flow in the inferior

alveolar artery and healing of incisional wound(s) in the mandibular vestibule or upper neck. Callus-free osteosynthesis ensues unabated in a majority of cases.^{1,2}

Traumatic degloving injuries of the oral cavity in the presence of fracture(s) of the anterior segment, however, pose a potential threat to the usual sequence of repair.

VASCULAR ANATOMY OF THE ANTERIOR SEGMENT

The mandible and anterior floor of the mouth enjoy a rich blood supply, by way of the larger terminal branches of the external carotid artery.³⁻¹⁰ In the case of the

¹University of Kentucky College of Medicine; ²University of Kentucky College of Dentistry, Lexington, Kentucky; ³University of Louisville School of Medicine, Louisville, Kentucky.

Address for correspondence and reprint requests: Richard A. Pollock, M.D., Departments of Surgery, Anatomy and Neurobiology and Biomedical Engineering, University of Kentucky College of Medicine, 751 Rose Street, 109e Nursing Building, Lexington, KY 40536-0232 (e-mail: dpollock@mcpollock.com).

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Figure 1 The inner cortex and lingual periosteum of the mandible and floor of the mouth are supplied by a three-tiered distribution of vessels, best seen on an oblique lingual view of the right mandible (A) and in cross section in the area of parasymphysis on the left (B).

mandible, distribution is by endosteal and by the inner and outer periosteal systems.

The internal maxillary artery is first imbedded in the deep lobe of the parotid gland, behind the neck of the mandible. Several branches are given off in this paramandibular location, including the inferior alveolar artery. The latter plunges downward, leaving the parotid gland to penetrate the mandibular foramen and to provide endosteal supply (Fig. 1).^{5,10}

Before the inferior alveolar artery enters the mandibular foramen, the vessel gives off two branches, the lingual and the mylohyoid. The lingual branch follows the lingual nerve to supply the mucous membrane of the floor of the mouth. The mylohyoid branch

runs in the mylohyoid groove then ramifies on the undersurface of the mylohyoideus to vascularize the periosteum of the lower inner cortex. These branches of the inferior alveolar artery are supplemented in the floor of the mouth by the deep lingual artery, a direct branch of the external carotid artery. The blood supply to the inner cortex is tiered, above and below the mylohyoid muscle (Fig. 1).

The inferior alveolar artery courses mesially within the bone of the mandible and bifurcates opposite the first premolar tooth into mental and incisor branches. During their course forward, random twigs are issued to the cancellous (trabecular) bone, and more orderly branches are provided to the roots of the teeth.

Figure 2 Endosteal blood supply is delivered by the arborization of a single vessel, demonstrated by injection of the inferior alveolar artery with India ink. (Courtesy of Dempster and Enlow.)¹³

These dedicated vessels enter the diminutive extremities of the roots to reach the pulp of the teeth.^{5,6,9,10}

The incisor branch continues forward and anastomoses at the midline, with the artery of the opposite side. The mental branch emerges from the mental foramen, to anastomose with the submental, inferior labial, and facial arteries.

This rich arborization of vessels (Fig. 2) was apparent to Cryer¹¹ at the turn of the 19th century but was dramatized by injections of India ink in studies by Knapp et al,¹² Dempster and Enlow,¹³ and Cohen¹⁴ at midcentury.

PATHOMECHANICS OF LINGUAL DEGLOVING

High-speed cinematography and finite analysis (using high-speed computers and strain gauges) demonstrate that fractures of the anterior segment begin at the inner cortex and propagate outwardly to the outer cortex, then on to other areas of the craniofacial skeleton.^{15–17}

Rebound of bone fragments (recoil) is part of the biomechanical process of injury (Fig. 3), and recoil after injury is most apparent in the more pliable bone of youth. The anterior mandible is seen to displace inwardly and “snap back,” sometimes into full anatomic position. This to-and-fro movement of the anterior segment is most apparent with bilateral fractures at a younger age¹⁸ and lead to separation of the soft tissue from the lingual surface of the symphysis. Oral degloving appears to be favored in youth and early adulthood by the relatively immature attachment of the periosteum and the mylohyoid, genioglossus, geniohyoid, and digastric musculature to the inner cortex of the anterior segment and by two (multiple) fractures.

In our collective experience with an estimated 15 cases, degloving may be small or large. The larger

Figure 3 Degloving of the lingual (inner) surface of the anterior segment of the mandible follows “to-and-fro” displacement of the fracture segments, creating a clinically recognizable void of variable size, in the floor of the mouth.

void follows bilateral fractures. The smaller void follows a single symphyseal or parasymphyseal fracture. In parasymphyseal fractures, the void may track distally to expose the anterolateral body of the mandible. The affected patient in either case presents with a void in the anterior floor of the mouth (Fig. 3).

CASE REPORT

An 8-year-old boy suffered right parasymphyseal and left symphyseal fractures of the mandible, with degloving of the anterior floor of the mouth and exposure of the mesial, lingual cortex. An incision in the vestibule was circumvented by choice of a submental incision when it was deemed that open reduction was a more favorable option than closed reduction.

The fractures were stabilized with a locking bicortical plate and a monocortical tension band at each fracture site (Fig. 4A to 4G). The Ernst ligatures were removed. The submental incision and intraoral void were closed, the latter with several interrupted, resorbable horizontal mattress sutures, which passed between nearby teeth to purchase the avulsed soft tissue cuff. Copious irrigation and perioperative antibiotics preceded soft tissue repair.

The appliances were removed a few weeks after surgery, again through a submental incision.

DISCUSSION

Traumatic degloving of the lower jaw may involve the outer or inner cortex (Table 1). Our combined experience and the few reports in the literature^{19–29} suggest

Figure 4 (A–G) An 8-year-old boy presented with right parasymphyseal and left symphyseal fractures and a void in the anterior floor of mouth. Submental incision allowed uncompromised reduction and stabilization.

Table 1 Comparison of Buccal and Lingual Degloving Injuries of the Mandible

Fracture(s) of the Anterior Segment with Partial or Total Disruption of Endosteal Blood Supply	
A	B
Traumatic degloving of <i>buccal</i> cortex, with partial or total disruption of mental, facial, and superior labial vessels	Traumatic degloving of <i>lingual</i> cortex, with partial or total disruption of lingual, mylohyoid, and deep lingual vessels
Vestibular incision, if needed; broad exposure of bone fragments	Submental incision; limited elevation of the buccal periosteum
Manipulation and direct stabilization of fracture segments	Manipulation and direct stabilization of fracture segments

that separation of the soft tissue mask from the *outer* surface of the symphysis and parasymphysis, after trauma, is more common than degloving of the oral cavity from the *inner* cortex. No report to date has cautioned surgeons regarding the potentially added risk that denudation of the *inner* anterior or the anterolateral segment of the mandible poses to fracture repair.

Parallels to traumatic degloving of the mandible have been reported in elective surgery. Loss of bone, soft

tissue, or selected teeth in the anterior segment, for example, has followed elective orthognathic surgery. Oral surgeons in these cases logically presume that endosteal and inner periosteal vessels are unable to sustain the anterior segment after select vestibular incisions, wide periosteal elevation, and osteotomies.^{30,31} We surmise that posttraumatic denudation of the inner cortex of the mandible raises the same specter of risk, and we have offered an illustrative case report.

Figure 5 (A, B) When the inner cortex has been avulsed from the buccal (posterior) margin of the teeth, interrupted resorbable suture is passed between the teeth (interdigital) to purchase the soft tissue cuff and close the void.

Figure 6 (A, B) If a sufficient lingual, gingival cuff is present, direct closure of the void is achieved using running, resorbable horizontal mattress suture. Interrupted sutures may buttress the repair.

When preoperative assessment suggests intraoral appliances will provide sufficient stability of fractured segments, we have chosen closed reduction, using Erich arch bars or Ernst ligatures. When an *open* approach is necessary to ensure proper alignment and stability, we recommend a submental incision, thus limiting elevation of the periosteum on the outer surface of the potentially compromised anterior segment. The mandibular vestibule and buccal gingiva are avoided and thus not violated.

We further advise in these circumstances copious irrigation and closure of the void with continuous or interrupted horizontal mattress resorbable suture (Figs. 5 and 6). When horizontal mattress sutures are used, we prefer the additional use of one or two interrupted mattress sutures, to buttress the repair. Weekly follow-up to ensure meticulous intraoral hygiene is recommended.

The case presented in this report does *not* fully illustrate the spectrum of possible lingual, soft tissue injury seen in clinical and trauma center practice. Nevertheless, it is our intent to alert surgeons to the potential endangerment created by inner cortical degloving and concomitant fracture(s) of the anterior segment.

CONCLUSION

In contrast to routine experience, the authors opine that oral degloving should provoke contemplative thought, judicious evaluation, and measured intervention, because of the following.

- The periosteal blood supply to the inner cortex, provided by the lingual and mylohyoid branches of the inferior alveolar artery and the deep lingual artery, is compromised.

- The endosteal blood supply may fail or be slow to recanalize.
- An otherwise routine incision in the mandibular vestibule may render the bone relatively avascular and put survival of the anterior segment of the mandible at risk.

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