Prevention of Dental Injuries in the Operating Room

Manny Vallejo, M.D., D.M.D.

Magee-Womens Hospital
University of Pittsburgh Medical Center
Did You Know?

• Dental injury is the most common medico legal complaint against anesthesia providers (33%-38%)
• Average cost = $1,672 ± $2,378 (0 – $8,038)
• 62% of injured teeth have been previously restored or are associated with periodontal disease
Incidence of Dental/Oral Injury

- 0.02% - 0.7% (retrospective)
- 12.1% (prospective)
- Oral injuries = 18%
Teeth at risk for injury

- **Maxillary central incisors** are most at risk
- Single tooth usually involved - only 13% > 1 tooth
- **Left** maxillary central incisor is most at risk (51%*)
Facts

- Damage is $5x$ more likely with a pre-existing dental condition
- Most injuries $\Rightarrow$ crown fractures + partial dislocations
- Non restored teeth $\Rightarrow$ incisal chipping
- Isolated teeth $\Rightarrow$ dislodgement
- Orthodontic treatment $\Rightarrow$ tooth mobility and root resorption
Odds Ratio for General Anesthesia

- Risk for dental injury with general anesthesia compared to risk without general anesthesia (i.e. MAC, regional, local) = 89:1

\[
\begin{align*}
\text{General Anesthesia} & = 89 \\
\text{MAC, Regional, Local} & = 1
\end{align*}
\]
Odds Ratio for General Anesthesia with Endotracheal Intubation

• General Anesthesia (GA) risk for dental injury with endotracheal intubation compared to without endotracheal intubation = \( 24:1 \)

\[
\frac{\text{GA + Endotracheal Intubation}}{\text{GA without Endotracheal Intubation}} = \frac{24}{1}
\]
Odds Ratio for a Pre-existing Dental Condition

- Risk for dental injury with a pre-existing dental condition (dental caries, periodontal disease, dental restoration = crown, bridge, extensive filling, etc...) = $50:1$

\[
\frac{\text{Pre-existing dental condition}}{\text{Healthy non-restored teeth}} = \frac{50}{1}
\]
Minor Dental Injury Risk Factors

• Anterior crowding
• Craniofacial abnormalities
• Difficult airway
• Emergency
• Limited neck movement
• Young (deciduous teeth)
48 Dental Injuries Identified

- Demographics
  - Age (yrs) = 51.54 ± 15.73
  - Men = 39.6%
  - Women = 60.4%
UPMC Anesthesia Claims Database

- **Other Factors**
  - Emergency = 6.5%
  - Posterior tooth/teeth = 11.1%
  - Difficult Intubation = 18.4%
  - Tooth Fracture = 47.8%
  - Tooth Dislodgement = 48.9%
  - GETA* = 87.5%
  - Anterior tooth/teeth = 88.9%

*GETA = general endotracheal anesthesia*
Number of Dental Injuries per UPMC Hospital (October 2000 - June 2004)

- Presbyterian: 29
- Shadyside: 7
- Montefiore: 5
- Magee-Womens: 4
- St. Margaret: 2
- Southside: 1

[Bar chart showing the number of dental injuries at each hospital]
Risk Related to Time in Case

- Intubation is most common (50-75%)
- Extubation (9%)
- Emergence + Recovery (9%) $\Rightarrow$ due to shivering and bruxism
Risk Related to Procedures

- Emergency cases
- Difficult intubation
- Laryngoscopy ⇒ upper incisors
- Oropharyngeal airways ⇒ upper and lower incisors
- Endoscopy
- Suctioning ⇒ back teeth
Miller Blade
McIntosh Blade
Oropharyngeal Airways

- OPA’s put excessive lateral forces on the maxillary and mandibular anterior teeth.
- Anterior maxillary teeth have a slight forward inclination and the overlapping lower anterior mandibular teeth renders them susceptible to a levering effect with OPA’s.
Oropharyngeal Airway (OPA)

- Used in the prevention of endotracheal tube kinking during anesthesia
- Decreases risk for dental injury **ONLY** when placed on healthy non-restored anterior teeth
- Increases risk for injury when:
  - Used on restored anterior teeth (big fillings, caps, bridges, veneers etc…)
  - Forcefully removed when teeth are clenched
  - Left in place during shivering and/or muscle spasm
Endoscopy
Suctioning
Patient Initiated Events

• Often during recovery room care
• Events include:
  – Shivering
  – Masseter muscle spasm
  – Teeth grinding or clenching (bruxism)
  – Biting (especially on hard objects such as OPA)
Dental Injury Mechanism

- Pre-existing dental condition (i.e. “tooth/teeth at risk”)
- Physical event (i.e. laryngoscopy)
- Tooth position (anterior > posterior)

Pre-existing dental condition + Physical event = Dental Injury
Dental Caries

- Cavities weaken the tooth/teeth and make fracture more likely
Risk Related to Dental Restoration

- Removal of tooth structure ultimately weakens the tooth
- Teeth with restorations are susceptible to fracture under high stress levels occasionally realized during mastication or bruxism
- These stress levels are *easily reached* during administration of or recovery from anesthesia
Dental Restorations

- Dental restorations **weaken** the tooth as it involves removal of some tooth structure.
- Composite restorations give an excellent cosmetic result but the rebuilt tooth is **weaker** than a natural tooth.
Dental Restorations

- Amalgam filling
- Crown with post
- Root canal
- Composite "white" filling
- Tooth pulp or nerve
- Possible early cavity
- Amalgam filling
- Crown with post
Crowns

• “Caps”
• Withstand forces in the **axial** direction (these forces are common during mastication)

Lateral forces (i.e. laryngoscopy, suctioning) can produce fractures and/or dislodgement
Bridge

- A series of **crowsns** joined together
- Anchoring crowns supported by **abutment teeth** on both ends
- Damage may necessitate **replacement** of the entire bridge
- Bridgework can be **extensive** and **expensive**

Lateral forces (i.e. laryngoscopy, suctioning) can produce fractures and/or dislodgement
Types of Bridges
Root Canal Therapy

• “Dead” teeth are more brittle than live teeth
• More likely to fracture under a heavy “load” (force)

Can fracture under the slightest axial or lateral force
Implants

- Can be used for single tooth replacement, multiple teeth replacement or even complete arch replacement
- Implants are extremely expensive to replace and can break or bend with disastrous consequences
Types of Dental Implants
Veneers

- Are very **thin** and tend to **fracture** on impact even under the slightest of force
Full Dentures

- Are **brittle** and are prone to fracture under minimal pressure
- Airway obstruction
- Endentulous patients are at risk for **mandibular fracture** during airway maneuvers
Removable Partial Dentures

- **Metal** framework covered by a layer of acrylic in which porcelain or plastic teeth are embedded.
- Retained in the mouth and stabilized by metal arms or **clasps** that partially surround abutment teeth.
- **Abutment teeth** are often mobile due to the stresses (torque) placed on them, and hence prone to **dislodgement**.
Isolated Teeth

- Prone to **damage** and **dislodgement**
- Forces are borne by the tooth **without** support of adjacent teeth
Abnormally Positioned/Crowded teeth

- More likely to be loaded with lateral forces and more likely to be loosened, fractured or avulsed, particularly if already loose
Periodontal Disease

- Tooth loss after the age of **30** is most often due to **periodontal disease**
- When the bony support of the tooth is lost due to periodontal disease, teeth are **dislodged** more easily
Q1. Pre-existing dental condition (i.e. tooth/teeth at risk)?

- Go to Q2.
- Yes
- No → Proceed with Surgery

Q2. General Endotracheal Anesthesia (GETA) involving laryngoscopy?

- Go to Q3.
- Yes
- No → Proceed with Surgery

Q3. Emergency Case?

- Go to Q4.
- Yes
- No → Delay + Referral

Q4. Can you modify GETA to decrease risk?*

- Go to Q5.
- No
- Yes → Modify and Proceed With Surgery

Q5. Can you use a Dental Injury protection device to decrease risk?*

- Go to 6.
- No
- Yes → Use Device and Proceed With Surgery

The DRRIPP Algorithm

1. Pre-existing dental condition (i.e. tooth/teeth at risk)?
   - No
     - (Low Risk for Dental Injury)
       - Proceed with Surgery
The DRRIPP Algorithm

1. Pre-existing dental condition (i.e. tooth/teeth at risk)?
   - Yes
     (High risk for Dental Injury)
   - Proceed to Question 2
Dental Risk Factors: Identifying “Tooth/Teeth at Risk”

- Dental Disease (periodontal disease, dental caries)
- Extensive dental restorations (Caps/Crowns/Bridges/Veneers/Devitalized teeth with root canal therapy/Dental implants)
- Chipped/Cracked/Brittle teeth
- Age (young primary deciduous teeth, elderly)
- Anterior crowding
- Protruding maxillary incisors
- Isolated tooth/teeth
The DRRIPP Algorithm

2. General Endotracheal Anesthesia (GETA) involving laryngoscopy?

   - No
     (Low Risk for Dental Injury)
     - Proceed with Surgery
2. General Endotracheal Anesthesia (GETA) involving laryngoscopy?

- Yes
  - (High Risk for Dental Injury)
  - Proceed to Question 3
Identify Key Anesthetic Risks

- The Big Three = Major Risk Factors
  1. General Anesthesia
  2. Endotracheal intubation
  3. Pre-existing dental/periodontal condition
The DRRIPP Algorithm

3. Emergency Case?
   - No
     - Delay Case
       - Dental Referral?
         - Proceed to Question 4
The DRRIPP Algorithm

3. Emergency Case?
   Yes (High Risk for Dental Injury)
   Proceed to Question 4
Consider Additional Risk Factors

- Emergency surgery
- Difficult airway assessment
- History of previous difficult intubation
- Use of OPA on “tooth/teeth at risk”
- Endoscopy
- Post-op Shivering
The DRRIPP Algorithm

4. Can you modify GETA to decrease risk?*

Yes
(Low Risk for Dental Injury)

Modify and Proceed With Surgery
Modifications*

- Modifications defined as “technique avoidance” such as switching to:
  - Regional Anesthesia
  - Local Anesthesia
  - Local Anesthesia with MAC
  - MAC alone
4. Can you modify GETA to decrease risk?

No
(High Risk for Dental Injury)

Proceed to Question 5.
5. Can you use a Dental Injury protection device to decrease risk?*

- Yes (Low Risk for Dental Injury)
  - Use protection device and Proceed with Surgery
Recommended Protection Devices

- **Bite block** placement on posterior teeth (premolars and molars) not at risk
- **Gauze rolls** placed on teeth not at risk for injury
- Customized mouth protector/splint
- Oropharyngeal airway only on “healthy” anterior teeth not at risk for dental injury
- **Endoscopic** bite block for oral endoscopy
The DRRIPP Algorithm

5. Can you use a Dental Injury protection device to decrease risk?
   - No
     - (High Risk for Dental Injury)
     - Proceed with Surgery:
       - Inform patient + document
       - high likelihood of dental injury
Proper Documentation = Recognition + Charting

Upper Maxillary Teeth

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

wisdom teeth  molars  bicuspid canines  incisors canines bicuspid molars wisdom teeth

32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17

Lower Mandibular Teeth

Permanent Dentition Identification
Review

- Patient specific risk factors
- Anesthesia specific risk factors
- Preoperative strategy
- Operative strategy
- Postoperative strategy
- Post dental injury strategy
- Application of the DRRIPP algorithm
Pre-op Prevention Strategy

• Identify
  – Patient Specific and Anesthetic related risk factors

• Review:
  – Dental history

• Perform:
  – Dental visual examination
  – Written documentation

• Provide:
  – Informed consent
  – Individualized and specific information about risk of dental injury
Preoperative Risk Assessment

• Identify patient specific risk factors
• Identify major anesthesia specific risk factors
• Identify minor anesthesia specific risk factors
• Documentation of adult teeth or pediatric teeth at risk for injury
Dental Risk Factors: Identifying “Tooth/Teeth at Risk”

- Dental Disease (periodontal disease, dental caries)
- Extensive dental restorations (Caps/Crowns/Bridges/Veneers/Devitalized teeth with root canal therapy/Dental implants)
- Chipped/Cracked/Brittle teeth
- Age (young primary deciduous teeth, elderly)
- Anterior crowding
- Protruding maxillary incisors
- Isolated tooth/teeth
Identify Key Anesthetic Risks

- The Big Three = Major Risk Factors
  1. General Anesthesia
  2. Endotracheal intubation
  3. Pre-existing dental/periodontal condition
Modifications*

- Modifications defined as "technique avoidance" such as switching to:
  - Regional Anesthesia
  - Local Anesthesia
  - Local Anesthesia with MAC
  - MAC alone
Intra-op Prevention Strategy

- **Distribute:**
  - Axial and lateral forces away from teeth prone to injury with “Dental Injury Protection Device” placed on teeth not at risk for dental injury *
- **Consider:**
  - Alternative intubation techniques (nasopharyngeal fiberoptic airway)
  - Recommended dental injury protection devices
- **Avoid:**
  - Forceful removal of airways, endotracheal tubes, and LMA’s when the teeth are clenched
  - Post-Op Shivering
- **Check for and document:**
  - Dental damage after intubation, extubation and recovery
Recommended Protection Devices

- **Bite block** placement on posterior teeth (premolars and molars) not at risk
- **Gauze rolls** placed on teeth not at risk for injury
- **Customized mouth protector/splint**
- **Oropharyngeal airway** only on “healthy” anterior teeth not at risk for dental injury
- **Endoscopic** bite block for oral endoscopy
Post Dental Injury Strategy

- Discuss
  - Injury ASAP with the patient
- Obtain:
  - Written estimates for necessary dental work
- Confer:
  - Agreement with patients to either reimburse them for the work required or to issue checks that will cover the expense of dental work to be done at a later date
- Document:
  - No financial compensation can occur without adequate documentation
Thank You!

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