Prevention of Athletic Dental Trauma and Sports Dentistry

DENT 5402
February, 2008
Mark Roettger DDS, FASD
roett003@umn.edu

Definition of Sports Dentistry

Sports dentistry involves the prevention and treatment of orofacial athletic dental injuries, and related diseases as well as the collection and dissemination of information on dental athletic injuries and the encouragement of research on prevention and treatment of such injuries.

Sports Related Oral Disease

- Oral Piercing
- Tooth injury
- Infection
- Enamel Erosion
- Sports drinks pH<3
- 1998-2003 sales up 465%
- Bulimia; wrestling, body image sports

Use of Spit Tobacco in Sports

- Widely used in many sports; all ages
- Athletes claim performance enhancement
- Not a safe alternative to smoking
- Increases risk of developing oral cancer
- Question athletes in your practice
Athletic Dental Trauma

Complex injuries involving multiple tissues with great healing potential if properly treated.

Dental Trauma: Mechanism

Direct Trauma

- The tooth itself is struck
- Injuries usually to anterior teeth
- Energy of impact: low mass, high velocity; high mass low velocity

Indirect Trauma

- Lower arch is forcefully closed against the upper
- Crown/root Fx in posterior teeth
- Jaw Fx
- TMJ injury
- Concussion?

Dental Trauma: Root Fracture

Dental Trauma: Luxation

Luxation Injuries

- Subluxation
- Lateral
- Extrusive
- Intrusive
Dental Trauma: Avulsion

Avulsion requires prompt Treatment: Re-implantation or proper transport medium 30 min (isotonic)
• Hank’s Balanced Salt Solution
• Milk
• Contact lens solution

Dental Trauma: Alveolar Bone Fracture

Dental Trauma: Soft Tissue Injuries

Dental Trauma: Significance

• Half of all children will suffer a dental injury by the time they graduate high school
• Sports activities cause the greatest percentage of traumatic injuries


Epidemiology of Dental Trauma

Football
• Prior to MG mandate: 50% of injuries to mouth and face
• After MG mandate: injuries to mouth and face decrease to 1.4%
• MG use prevents 150,000 to 200,000 injuries per year in the US

University of Minnesota Study
• Studied basketball, soccer and wrestling in Minnesota high schools
• 25% of soccer players had dental injury
• 50% of basketball players had dental injury
• 75% of wrestlers had dental injury
• Athletes reported > 100 injuries while trainers reported < 10
• Orthodontic appliances increased chance of injury
Participation, high school sports
2004-2005

USA
> 7 million

Minnesota
233,070

• Numbers have increased for 16 consecutive years
• Many trauma studies predict a 1 in 10 chance of a dental injury per season
• Translates to 700,000 oral sports injuries per year in the US; 23,000 in MN

Prevention: Who Should Wear Mouthguards

• Athletes in at risk sports (compared to football)
• Athletes with history of orofacial injury
• Orthodontic patients

Mouthguard History

• 1800’s boxing
• 1962 football mandate
• 1974 hockey mandate
• 1993 MSHSL mandate

Types of Mouthguards: Stock

• No customization
• Poor fit
• Interferes with speech
• Interferes with breathing
• Low athlete satisfaction

Types of Mouthguards: Mouth-formed

• Customized in the mouth
• Marginal fit
• Bulky
• Large variation in thickness
• Low athlete satisfaction
• Most common type
Types of Mouthguards: Custom

- Formed over a dental cast
- Best fit
- Most comfort
- Least interference with speech or breathing
- Highest athlete satisfaction

Types of Mouthguards: Gummy

- Not intended to protect teeth
- Can cause dental caries
- Coming soon; a football helmet made from marshmallows

Ideal Mouthguard

- Properly fitted
- Comfortable
- Speech
- Breathing
- Non-toxic
- Enhance performance
- Dentist input

IDEAL MOUTHGUARD:
- Proper Fit
- Concussion Resistant
- Dental Protection
- Joint Protection
- Cost Effective
- Accessible
Trauma Research

PDL fibroblasts immunohistochemical measurement of protein markers after avulsion.

Mouthguard Research


2-D finite element representation

Virtual Trauma

Validation of the Model

- Using low energy (0.5N) impacts that could be compared to in vivo displacements under similar loads (see graph)
- Demonstrates biofidelity of the model

Virtual Trauma: Effect of MG Thickness

Bone

Enamel

MG Stiffness MPa

Virtual Trauma: Effect of MG Stiffness on Shear Forces in PDL and Enamel

No mouthguard

Stiff mouthguard 900 MPa

Normal mouthguard 9-90 MPa

Virtual Trauma Conclusions

- **Hard object impacts**: increased thickness increases protection. Deformation increases contact time decreases force.
- **Soft object impacts**: increased stiffness decreases stress in tooth/bone complex. Increased thickness matters only in extra stiff material.
- Look for a composite material to combine shock absorption and high-stiffness to provide optimal protection under a variety of collisions.
Can MG Enhance Athletic Performance?

- 1950’s Notre Dame Dr John Stenger
- 1980’s Dr Harold Gelb MORA Dental Kinesiology
- Today: Neuroendocrineology

MG and Performance: Suppression of CRF by Biting:


- Recent stress and injury studies: stress interferes with certain aspects of vision
- If we reduce stress we can reduce more than just oral injuries
  - Better vision, better athlete and what is beyond vision stress effects wide reaching

Attitudes on Mouthguards

- Recommendation
- Mandate

Minnesota experience

Mouthguard Fabrication

Vacuum-formed vs. pressure-lamination

- Cost
- Availability
- Quality
- Research

Attitudes on Mouthguards

- Athletes: 50% believe they work
- Coaches: Extra hassle to deal with
- Trainers: Most believe in MG use
- Parents: Ugly media photos
- Mandate: 70-80% compliance
- Recommendation: <6% compliance
Mouthguards are as much a part of preventative dentistry as fluorides or dental sealants.