

Essential Aspects of Sports Dentistry

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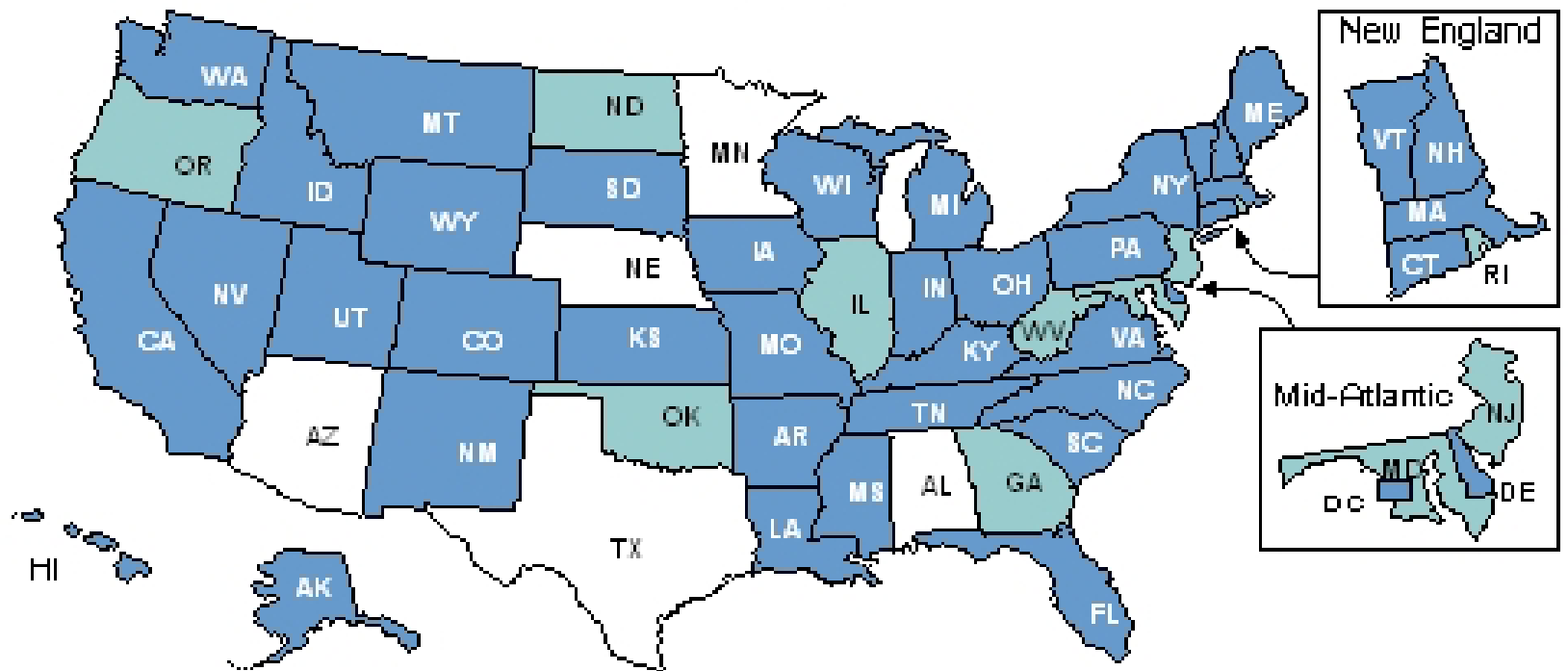
What is important to this audience?

- Informing and educating the public**
- Advocating for Optimal Health**
- Partner with others when making policies for specific groups**

Is this a public health concern?

- **Does this affect a significant population?**
- **Is there a Problem? Is there evidence of orofacial injuries in sports?**
- **Are there practical and meaningful strategies and for public education and prevention?**

States with Programs for Mouthguard/Injury Prevention 2008



 **Has Program**  **Does Not Have Program**  **Did Not Respond**

Source: The Association of State and Territorial Dental Directors and CDC Division of Oral Health's Synopses of State Dental Programs.

Participation Numbers

- **National Sporting Goods Association**
www.nsga.org
- **National Collegiate Athletic Association** www.ncaa.org
- **National Federation of State high School Associations**
www.nfhs.org

Ten-Year History of Sports Participation

*Participated more than once (in millions)
Seven (7) years of age and older*

Sport	2001	2003	2005	2007	2009	2011
Baseball	14.9	14.6	14.6	14.0	11.5	12.3
Basketball	28.1	27.9	29.9	24.1	24.4	26.1
Bicycle Riding	39.0	36.3	43.1	37.4	38.1	39.1
Football (Tackle)	8.6	8.7	9.9	9.2	8.9	9.0
Hockey (Ice)	2.2	1.8	2.4	2.1	3.1	3.0
Mountain Biking (Off Road)	6.3	8.2	9.2	9.3	8.4	6.0
Skateboarding	9.6	9.0	12.0	10.1	8.4	6.6
Skiing (Alpine)	7.7	6.8	6.9	6.4	7.0	6.9
Snowboarding	5.3	6.3	6.0	5.1	6.2	5.1
Soccer	13.9	11.1	14.1	13.8	13.6	13.9
Softball	13.2	11.8	14.1	12.4	11.8	10.4
Swimming	54.8	47.0	58.0	52.3	50.2	46.0
Volleyball	12.0	10.4	13.2	12.0	10.7	10.1
Wrestling	3.5	n/a	n/a	2.1	3.0	3.2

NATIONAL SPORTING GOODS ASSOCIATION (www.nsga.org)

Table Of Contents

« GO BACK

FULL SCREEN

Executive Summary.....	5	Average Number of Teams Per Institution	181
Introduction.....	6	Divisions I, II and III Overall Number of Women's Teams	182
Organization of the Report.....	6	Number of Division I Women's Teams	184
Changes to the Report.....	6	Number of Division II Women's Teams.....	186
Factors Affecting the Data.....	7	Number of Division III Women's Teams.....	188
Suggestions for the Reader	7	Divisions I, II and III Overall Number of Men's Teams.....	190
Definition of a Student-Athlete.....	7	Number of Division I Men's Teams	192
Findings.....	7	Number of Division II Men's Teams.....	194
Sports Sponsorship.....	7	Number of Division III Men's Teams.....	196
Sports Participation	8	NCAA Sports Participation – Number of Participants	
Teams Added.....	8	1981-82 – 2011-12.....	198
Teams Dropped.....	9	Average Number of Student-Athletes Per Institution	199
Net Change in Sports Sponsorship.....	9	Divisions I, II and III Overall Number of Female Student-	
Tables.....	10	Athletes	200
NCAA Year-By-Year Sports Participation 1981-82 – 2011-12.....	10	Number of Division I Female Student-Athletes	202
NCAA Championship Sports Participation 1981-82 – 2011-12	73	Number of Division II Female Student-Athletes.....	204
Divisions I, II and III Overall.....	74	Number of Division III Female Student-Athletes	206
Division I.....	75	Divisions I, II and III Overall Number of Male Student-	
Division II.....	76	Athletes	208
Division III	77	Number of Division I Male Student-Athletes	210
NCAA Championship Sports Sponsorship 1981-82 – 2011-12	78	Number of Division II Male Student-Athletes.....	212
Divisions I, II and III Overall.....	79	Number of Division III Male Student-Athletes	214
Division I.....	80	NCAA Sports Participation – Average Squad Size	
Division II.....	81	1981-82 – 2011-12.....	216
Division III	82	Divisions I, II and III Women's Teams Overall Average	
NCAA Sport-By-Sport Participation and Sponsorship –		Squad Size.....	217
Women's Sports 1981-82 – 2011-12	83	Number of Division I Women's Teams Average Squad Size.....	219
NCAA Sport-By-Sport Participation and Sponsorship –		Number of Division II Women's Teams Average Squad Size	221
Men's Sports 1981-82 – 2011-12	129	Number of Division III Women's Teams Average Squad Size.....	223
NCAA Sports Participation – Number of Teams		Divisions I, II and III Men's Teams Overall Average	
1981-82 – 2011-12.....	180	Squad Size.....	225
		Number of Division I Men's Teams Average Squad Size.....	227
		Number of Division II Men's Teams Average Squad Size	229
		Number of Division III Men's Teams Average Squad Size.....	231



2011-12 SUMMARY OF ATHLETICS PARTICIPATION TOTALS BY STATE

Rank	State	Boys	Girls	Total ¹	Rank	State	Boys	Girls	Total ¹
1.	Texas	490,816	317,990	808,806	27.	Mississippi	63,886	37,000	100,886
2.	California	456,633	325,279	781,912	28.	Oregon	56,218	42,372	98,590
3.	New York	215,447	174,028	389,475	29.	Kentucky	52,931	42,515	95,446
4.	Illinois	205,218	141,678	346,896	30.	South Carolina	60,112	34,193	94,305
5.	Ohio	197,420	135,929	333,349	31.	Alabama	60,360	29,400	89,760
6.	Pennsylvania	170,608	147,261	317,869	32.	Oklahoma	44,284	42,664	86,948
7.	Michigan	176,734	131,346	308,080	33.	Nebraska	45,751	31,258	77,009
8.	New Jersey	153,314	105,905	259,219	34.	Arkansas	35,967	21,556	57,523
9.	Florida	149,994	107,288	257,282	35.	Utah	33,625	23,304	56,929
10.	Minnesota	124,657	113,706	238,363	36.	Maine	29,028	23,964	52,992
11.	Massachusetts	123,567	95,365	218,932	37.	Idaho	25,945	19,006	44,951
12.	North Carolina	124,168	81,113	205,281	38.	New Hampshire	23,751	20,761	44,512
13.	Georgia	115,918	76,011	191,929	39.	New Mexico	24,276	19,526	43,802
14.	Wisconsin	112,754	78,938	191,692	40.	Nevada	26,153	16,225	42,378
15.	Virginia	100,968	72,885	173,853	41.	Hawaii	21,096	15,226	36,322
16.	Missouri	102,760	68,803	171,563	42.	West Virginia	21,137	14,895	36,032
17.	Washington	93,840	71,018	164,858	43.	Montana	18,468	14,029	32,497
18.	Indiana	90,380	61,333	151,713	44.	Rhode Island	16,449	12,126	28,575
19.	Iowa	84,479	57,314	141,793	45.	South Dakota	16,192	12,250	28,442
20.	Colorado	72,218	56,812	129,030	46.	Delaware	15,322	11,769	27,091
21.	Maryland	67,422	49,235	116,657	47.	North Dakota	14,853	10,646	25,499
22.	Arizona	61,767	49,925	111,692	48.	Alaska	12,042	10,313	22,355
23.	Connecticut	61,593	48,457	110,050	49.	Wyoming	10,681	8,236	18,917
24.	Tennessee	69,798	38,650	108,448	50.	Vermont	8,345	6,964	15,309
25.	Kansas	62,128	40,240	102,368	51.	District of Columbia	2,178	1,262	3,440
26.	Louisiana	61,336	39,564	100,900					

Sports Injury Numbers

- **Most common age for dental injuries is 8yrs old but for *SPORTS DENTAL INJURIES* is 13-18 yrs of age.**
- **Retrospective studies show 10-61% have experienced at least one orofacial injury during sports activities**

**Knapik JJ, et al. Mouthguards in Sports Activities
*Sports Med, 37(2):117-144, 2007***

Continued...

- **D.Kumamoto and Y. Maeda, “Global Trends and Epidemiology of Sports Injuries”, *J. Ped Dent Care*, 11(2):2005, 15-25.**
- 1.3%-71.5% Sports Orofacial Injury Rates**
- **“Retrospective surveys...10-61%...at least one orofacial injury during their participation in sports.”**
Knapik, JJ, et al, *Sports Med*
“Mouthguards in Sports Activities” 37(2):117-144,2007

Cause of Dental Related Sports Injuries

- **Impact with another player**
- **Impact with the ground or floor**
- **Impact with the playing instrument
or equipment (balls, pucks, sticks)**

Kaplan, et al 2000

Risk of Orofacial Sports Injuries by Category

- **Age**
- **Gender**
- **Dental Anatomy**
- **Individual Sports**

Gender

- **Males tend to outnumber females in injuries**
- **2012 Marked the 40th Anniversary of Title IX and the difference between men and women in orofacial sports injuries has changed**

Dental Anatomy as a Risk Factor



Typical Results

Normal overjet/Adequate lip coverage

7.1% dental trauma

Overjet >3 mm/ Adequate lip coverage

11.3% dental trauma

Overjet >3mm/ Inadequate lip coverage

13.5% dental trauma

Bauss, et al, Dent Traum,2004

Sport Classification

■ Non Contact

Low Velocity

High Velocity

■ Contact

■ Collision

Non Contact Low Velocity

- Golf
- Swimming
- Billiards
- Nordic Skiing
- Curling
- Weightlifting



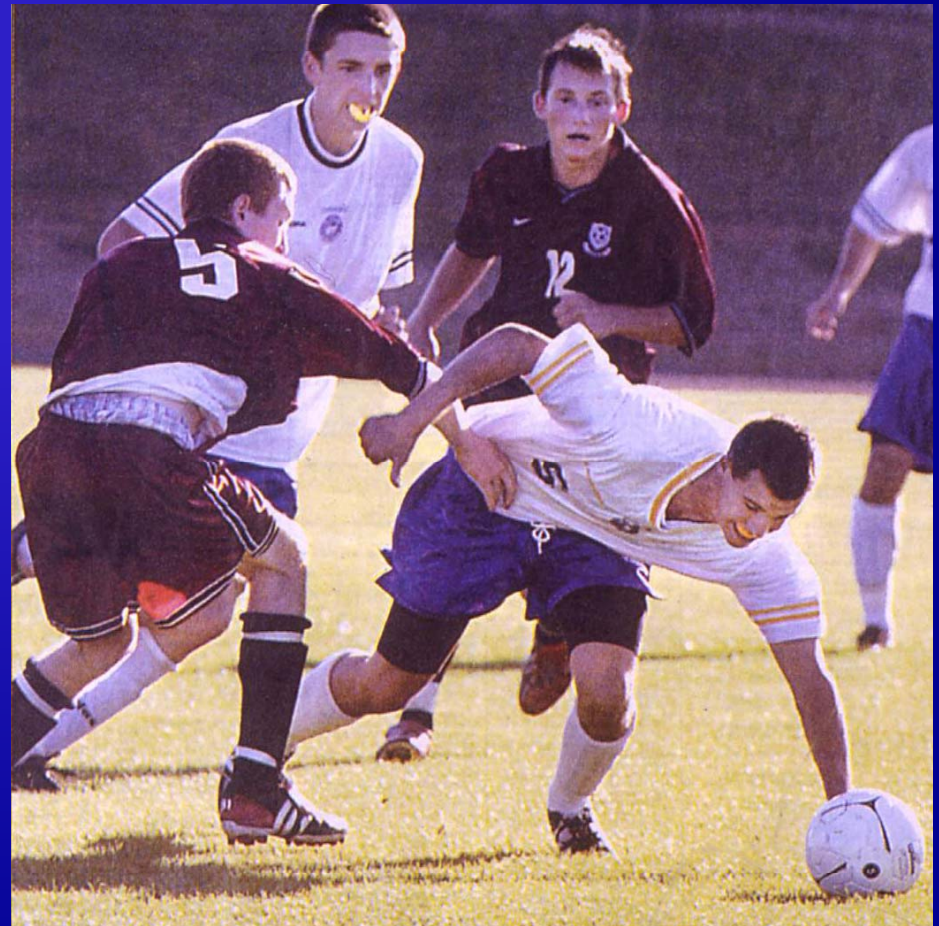
Non Contact High Velocity

- **Alpine skiing**
- **Cycling(Mountain and Street)**
- **Extreme sports**
 - skateboarding**
 - stunt biking**
- **Horse racing**
- **Rodeo**



Contact Sports

- Basketball
- Soccer
- Wrestling
- Lacrosse
- Volleyball
- Field Hockey
- Baseball



Collision Sports

- **American Football**
- **Australian Rules Football**
- **Rugby**
- **Ice Hockey**
- **Boxing**



Kumamoto and Maeda

- **Basketball (2.3-55.1%)**
- **Baseball/Softball (1.6-40%)**
- **Soccer (2.6-32.3%)**
- **Bicycle (5.6-30%)**
- **Rugby (6.7-71.9%)**
- **Ice hockey, Field Hockey,
Lacrosse (1.3%-29.72%)**

So, the numbers are there.

“...it is possible to argue that the best strategic measure for preventing dental and oral injuries is education on both how to avoid them and what to do if an injury occurs.”

A. Sigurdsson, “Evidence-based review of prevention of Dental Injuries” *Ped Dent* 35(2):184-190. 2013

Inform/ Educate the Public

- **Immediate Recognition and Handling of Orofacial Injuries**
- **Prevention/Mouthguard Options**
- **Examples of Attempts to Mandate mouthguard Usage**

What's Important in Dental Traumatology

- Mechanism of dental injuries
- Classification of dental injuries
- Management of dental injuries
 1. Acute care
 2. Subacute care
 3. Delayed care



Oral Injuries: A Quick Overview

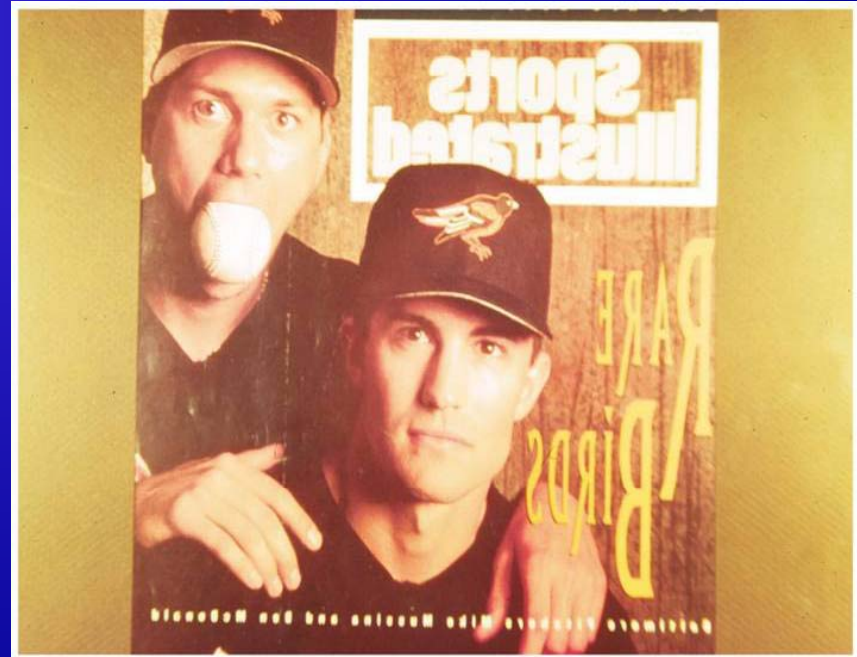


Oral Injuries

Collision with others



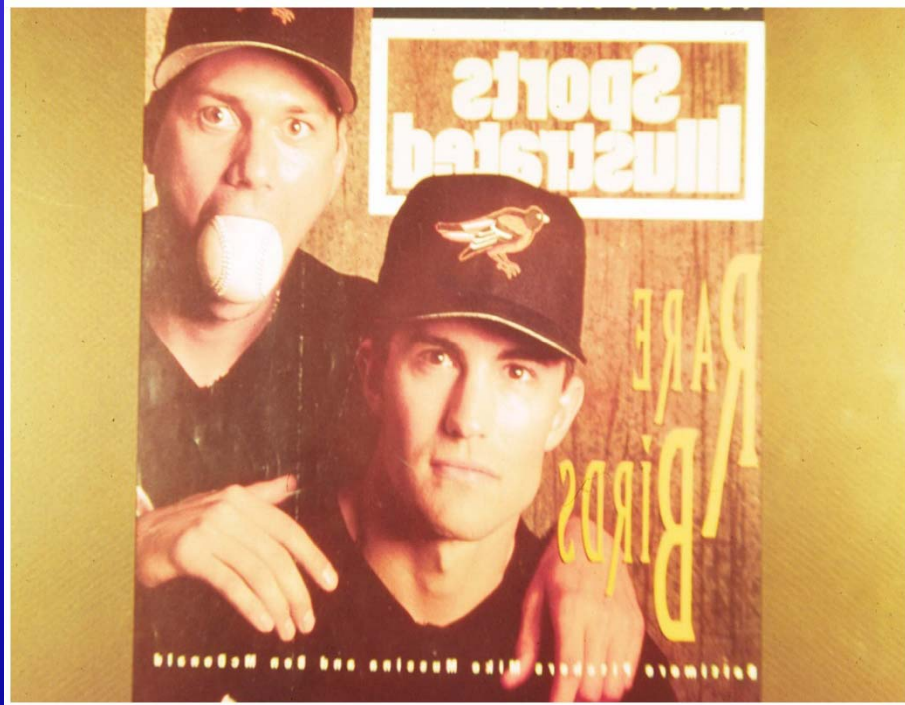
Collision with objects



Dental Trauma: Mechanism

Direct

Direct Trauma

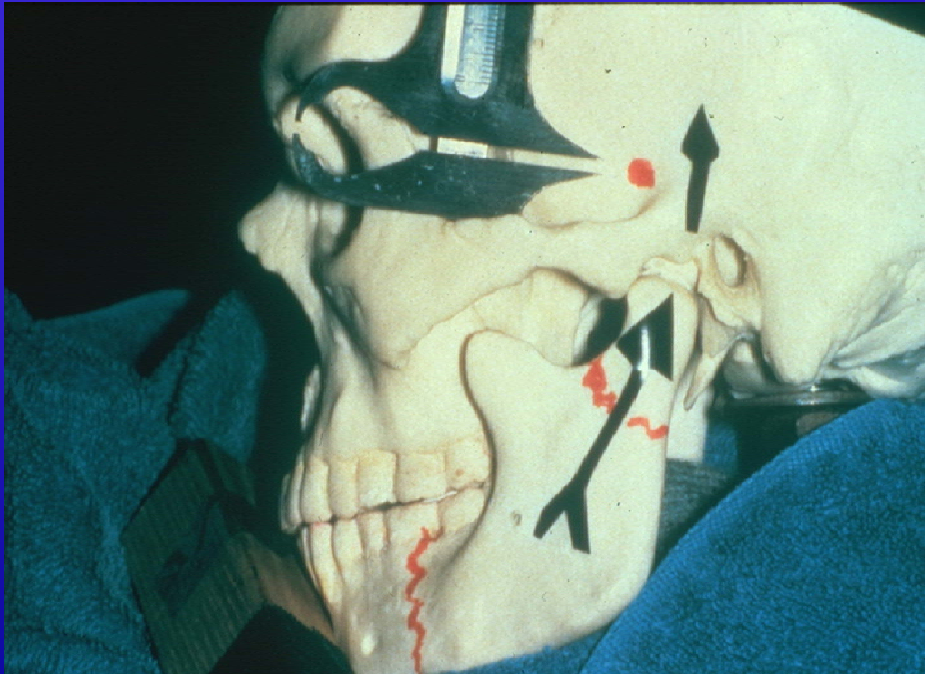


- The tooth itself is struck
- Injuries usually to anterior teeth; luxations, avulsions and fractures
- Energy of impact: low mass, high velocity; high mass low velocity

Dental Trauma: Mechanism

Indirect

Indirect Trauma



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

Results of Oral Collisions

Teeth can break

Fracture



Teeth can move

Luxation



Results of Oral Collisions

Teeth can move a long way

Avulsion



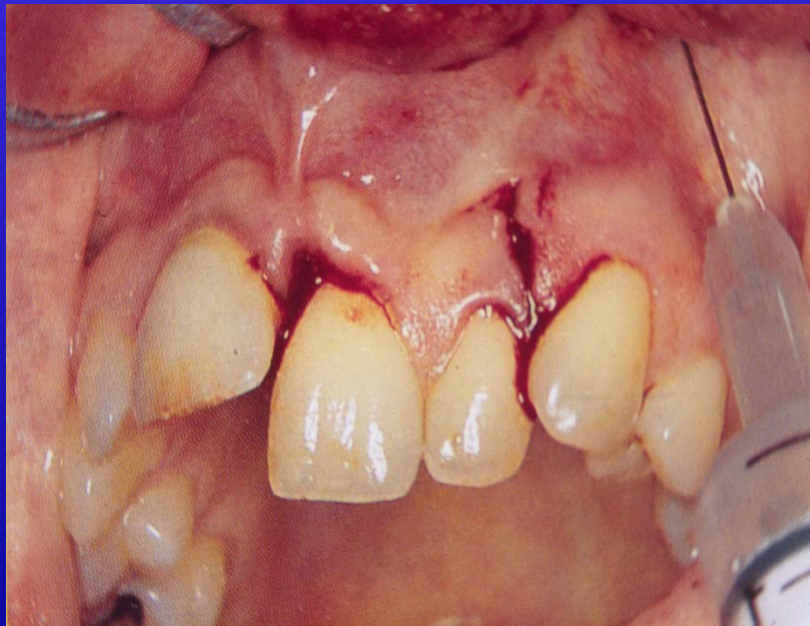
Teeth can act as weapons

Lip laceration



Results of Oral Collisions

Bone may fracture



Mandibular fracture



Nature of Dental Trauma



Complex Injuries:

- Involving multiple tissues
- Damage to intercellular components; tearing
- Damage to cellular systems; crush, desiccation, contamination
- Tx aimed at resolving all damage

Classification of Dental Injuries

Anatomical

Injuries to dental hard tissues and pulp

- Enamel fracture
- Enamel-dentin fracture (simple)
- Complex crown fracture
- Crown-root fracture
- Root fracture

Classification of Dental Injuries

Anatomical

Injuries to the periodontal tissues

- Concussion
- Subluxation
- Extrusive luxation
- Lateral luxation
- Intrusive luxation
- Avulsion

Classification of Dental Injuries

Anatomical

Injuries to gingival or oral mucosa

- Laceration
- Contusion
- Abrasion

Always look for combination of injuries!!!



Management of Dental Trauma



1. Education of dental providers
2. Education of the general public

Immediate vs Delayed Treatment

1. Acute: minutes to hours
2. Subacute: within 24 hrs
3. Delayed: >24 hrs

Acute dental care required

- Avulsion
- Alveolar fracture
- Extrusive luxation
- Lateral luxation
- Root fracture



Subacute dental care required

- Intrusion
- Concussion and subluxation
- Crown fractures complex: pain
- Primary teeth



Delayed dental care

- Simple crown fractures
- Non-painful complex crown fractures

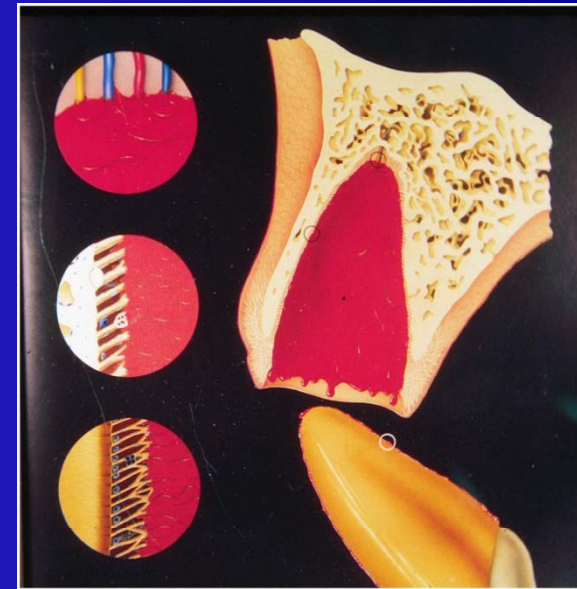


Avulsion: A Public Health Opportunity



1. Educate dental providers
2. Educate the general public, parents, trainers and coaches

Avulsion: The Injury



- Tooth completely displaced from socket, clinically socket is empty or filled w coagulum
- PDL and pulp suffer ischemic injury, aggravated by drying, infection and chemical irritation

Avulsion

- Historically the management of these injuries have been fraught with confusion
- The goal of treatment is to regenerate a new PDL and perform endodontic therapy
- Magic solutions and treatments have been proposed
- How do we achieve the stated goals??
- Follow the science...

Research Summary: Effects of dry time on PDL regeneration

- **Less than 5 min.** extra oral dry time, PDL cells maintain vitality and fibrogenic phenotype **Result: regeneration of PDL likely**
- **Greater than 5 min, but less than 15 min** of extra oral dry time, cells maintain vitality but begin to exhibit osteogenic phenotype **Result: Ankylosis likely**
- **Greater than 15 min** extra oral dry time cells lose vitality and die; losing the ability to make clones to repopulate the root surface.
Result: Ankylosis

Consequences of Ankylosis

Non-growing patient



Growing patient



Considering this Information...



What do we tell the public?
What do we tell dental providers?

First Aid for Avulsed teeth

Dentists should be able to give phone advice to patients

- Make sure it is a permanent tooth
- Keep the patient calm
- Pick up tooth by the crown (whitest part) avoid touching the root
- If tooth is dirty wash it; cold running water 10s and replant the tooth
- If not possible place the tooth in cold milk; if no milk is available transport in the mouth is ok; if the child is young or unconscious get saliva in a cup and transport; no water
- Get emergency dental care immediately

Dental office Procedures:

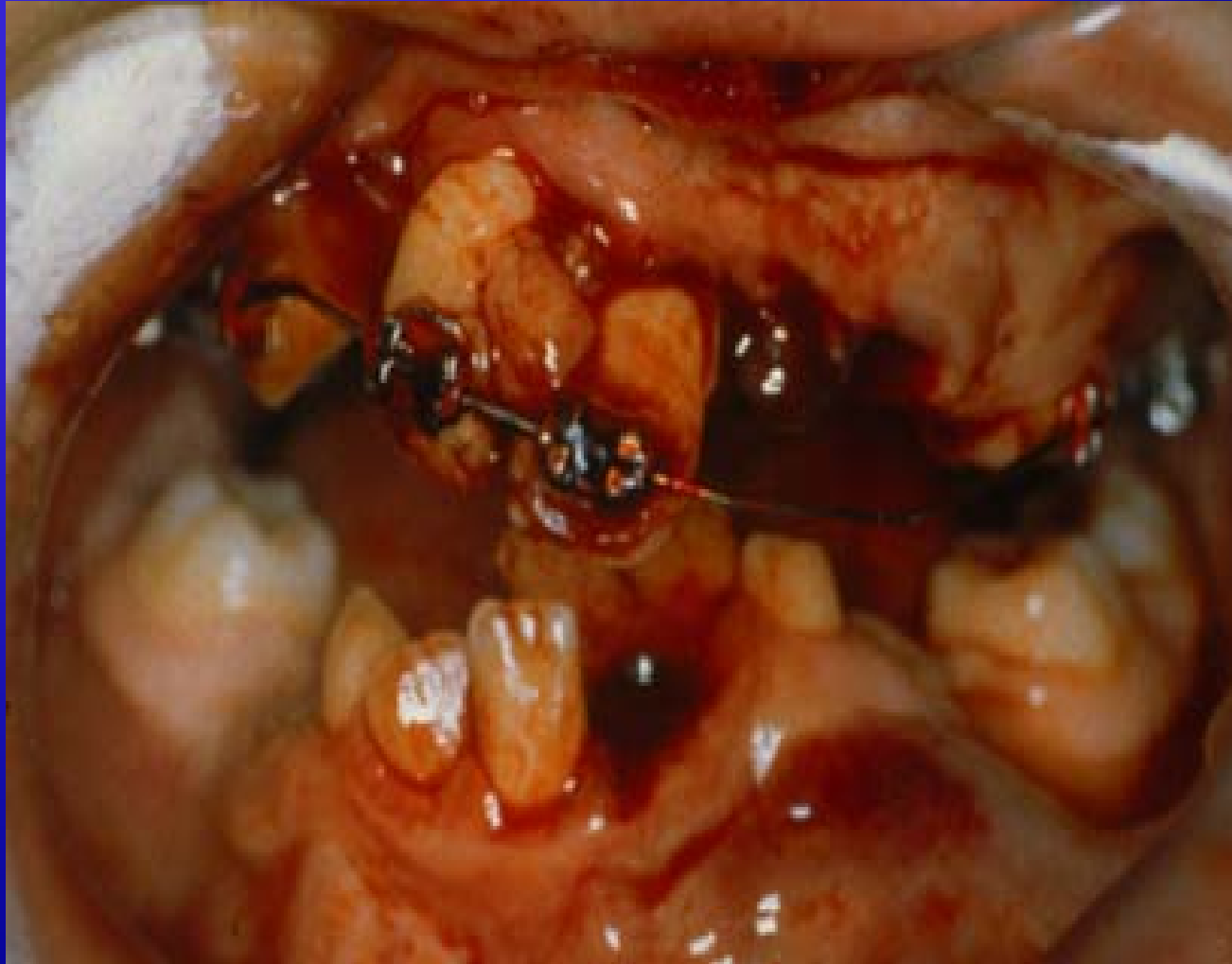
1. Clean the root with saline and soak in saline
2. Administer local anesthesia
3. Irrigate the socket with saline
4. Replant the tooth slowly
5. Suture gingival lacerations if present
6. Verify normal position: clinically/radiograph
7. Apply flexible splint for 2 weeks
8. Systemic antibiotics
9. Check tetanus status
10. Patient instruction
11. Start endo on mature root 7-10 d; monitor immature tooth for pulp regeneration

What if...the tooth is **NOT** replanted
within 5 minutes???



People are squeamish...and not all injuries look like this

Some look like this!!!!



Avulsion Treatment

When immediate reimplantation is not possible:

- Proper storage medium is required 5Minutes
- Proper osmolality (280-300 mOs), cell nutrients
- Hanks balanced salt solution
- Cold milk
- Isotonic saline (contact lens solution)

Avulsion management

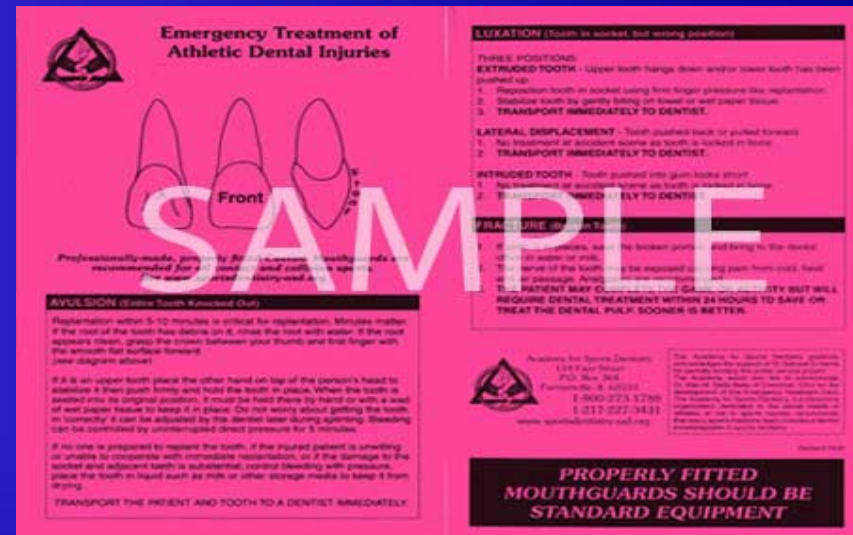
To maximize healing potential:

- Replant the tooth within **5 minutes**

OR

- Place tooth in a proper storage medium within **5 minutes** of the trauma

Resources For Dental Trauma information



- ASD Trauma card

www.academyforsportsdentistry.org

- IADT Treatment guidelines

www.iadt-dentaltrauma.org

- The Dental Trauma Guide

www.dentaltraumaguide.org

Prevention of Injuries

The Athletic Mouthguard



That Reference again...

J.J. Knapik. “Mouthguards in Sports Activities, History, Properties, and Injury Prevention Effectiveness.” *Sports Med*, 37(2):117-144. 2007

A.K. Mascarenhas. “Mouthguards reduce orofacial injury during sport activities, but may not reduce concussions” *JEBDP*, 12(2):90-91, June 2012.

ASTM

Designation: F 697 – 00 (Reapproved 2006) An American National Standard Standard Practice for Care and Use of Athletic Mouth Protectors 1

Classification

3.1 Mouth protectors covered by this practice shall be of the

following types and classes:

3.1.1 Type I—Thermoplastic Type:

3.1.1.1 Class 1—Vacuum-formed.

3.1.1.2 Class 2—Mouth-formed.

3.1.2 Type II—Thermosetting Type:

3.1.2.1 Class 1—Mouth-formed.

3.1.3 Type III—Stock type.

Stock Mouthguard

Mouth formed

Custom Fitted

The (Updated) Functions of a Mouthguard

- **Dental Protection**
- **Soft Tissue Protection**
- **TMJ protection**
- **Bone protection**
- **Concussion Protection**
- **Systemic Influences**

Does it work?

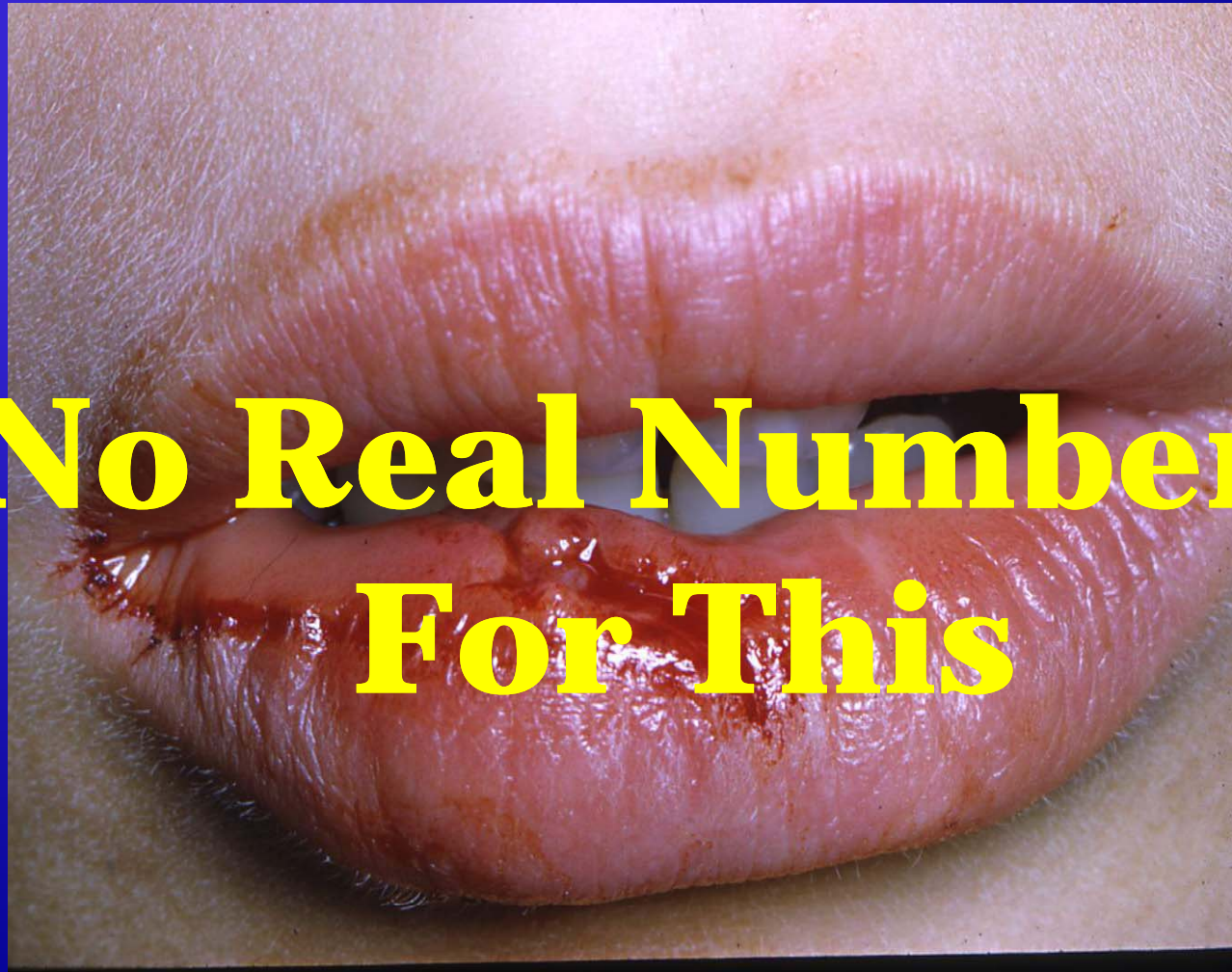
Protect the Teeth From Fracture

Overall injury reductions of 1.6-1.9 times fewer injuries with mouthguards.

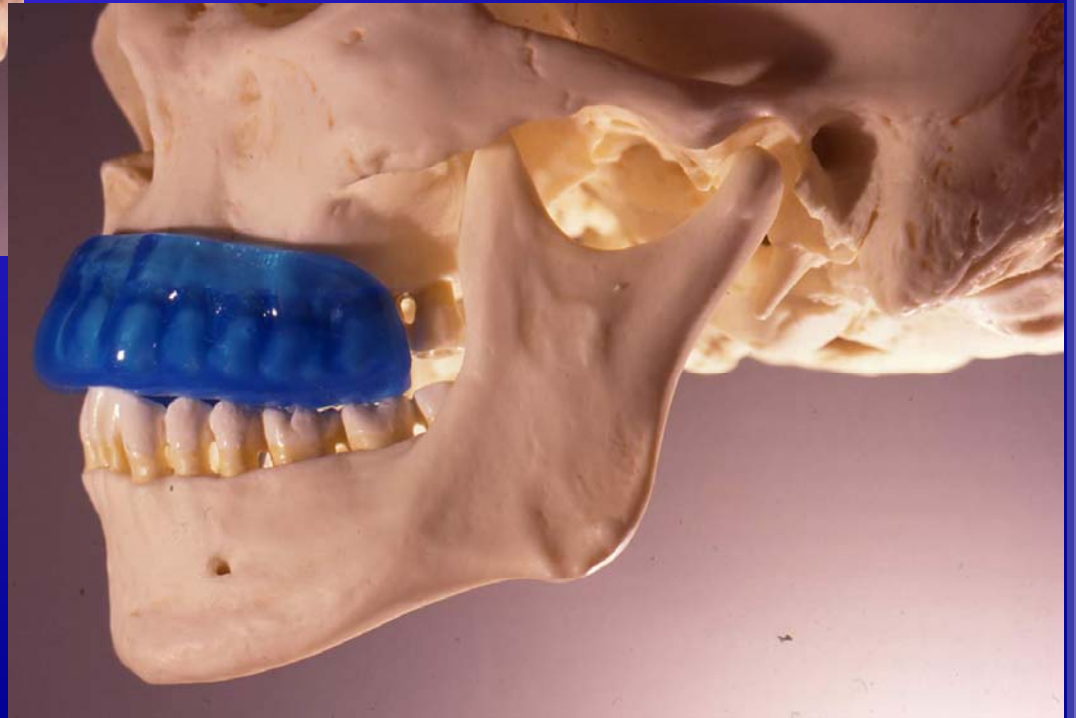


Soft tissue protection

**No Real Numbers
For This**



TMJ Protection



TMJ Protection

- **No real numbers for this**
- **The most protected position is fully engaged occluded teeth**
- **Need a locked occlusion**

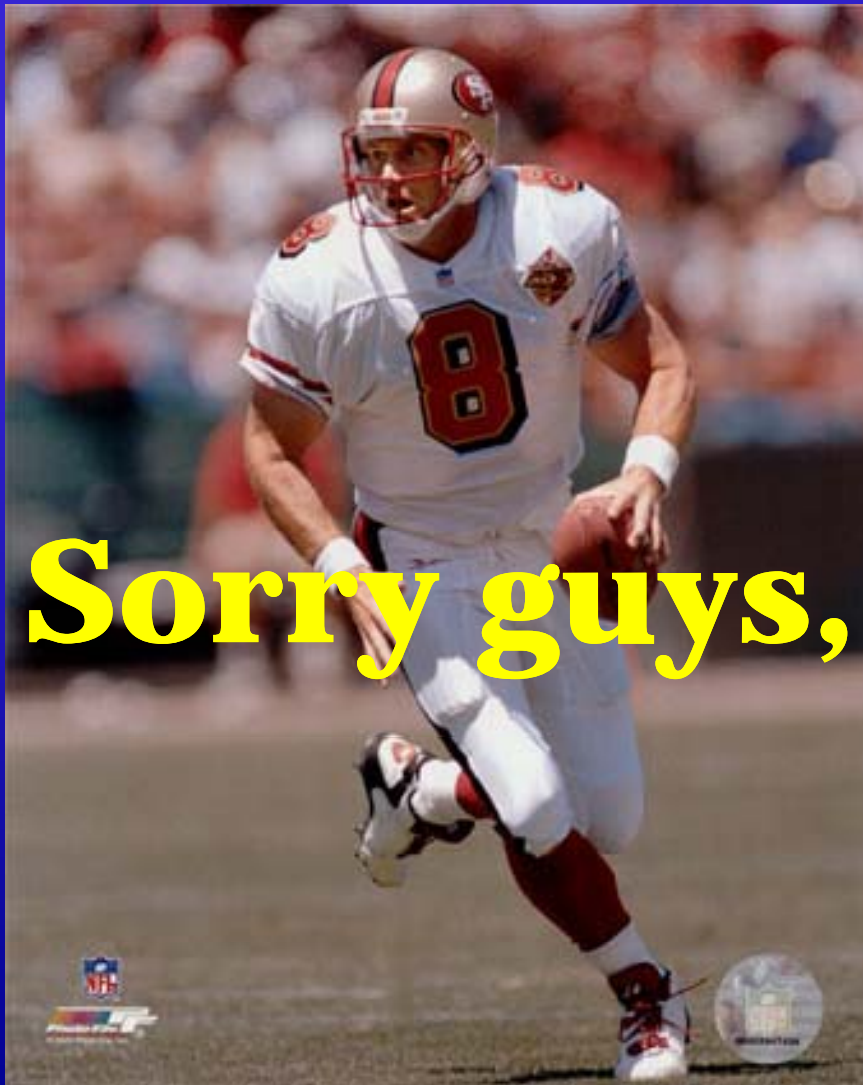
Bone Fracture Protection



Bone Protection

- **Hickey, et al 1967**
measured bone
deformation
- **Takeda, T., et al, *Dent***
Trauma, 20:150-156, 2004

Concussion Protection



Sorry guys, no numbers

Mark!!!!

In Fact....

For Release: 11/29/2012

**FTC Approves Final Order Settling
Charges Against Marketer Brain-Pad,
Inc. for Allegedly Deceptive Claims that
Its Mouthguards Can Reduce Risk of
Concussions**

**Agency Sends Warning Letters to 18
Other Marketers of Anti-Concussion
Products**

Systemic influences of intraoral appliance wear

- **MORA appliance early 80's**
- **New Styles available**
- **Jury is still out.**

Biting Suppresses Stress-induced Expression of Corticotropin-releasing Factor (CRF) in the Rat Hypothalamus

N. Hori et al ; J Dent Res 83(2):124-128, 2004

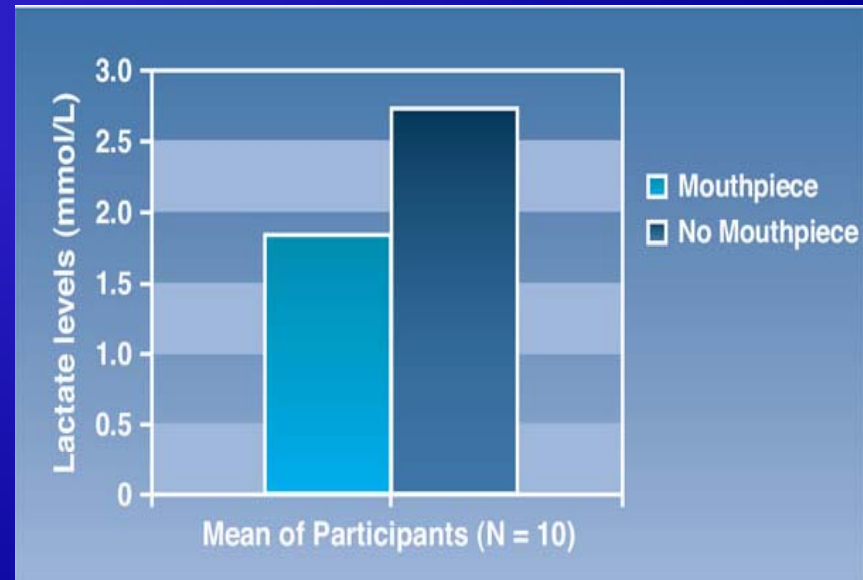
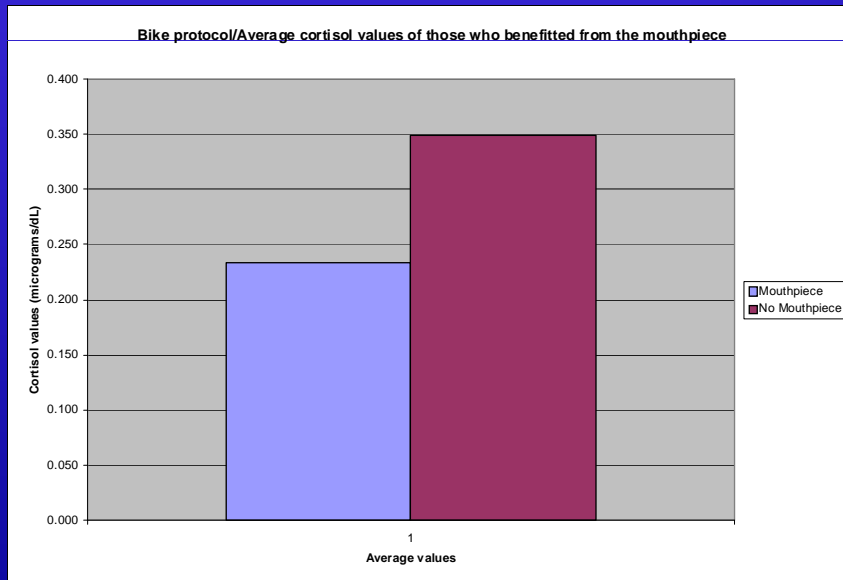
Methods:

- Stressed a group of rats
- Part of the group was allowed to bite on sticks during stress and part was not
- Subjects were sacrificed and brains were analyzed

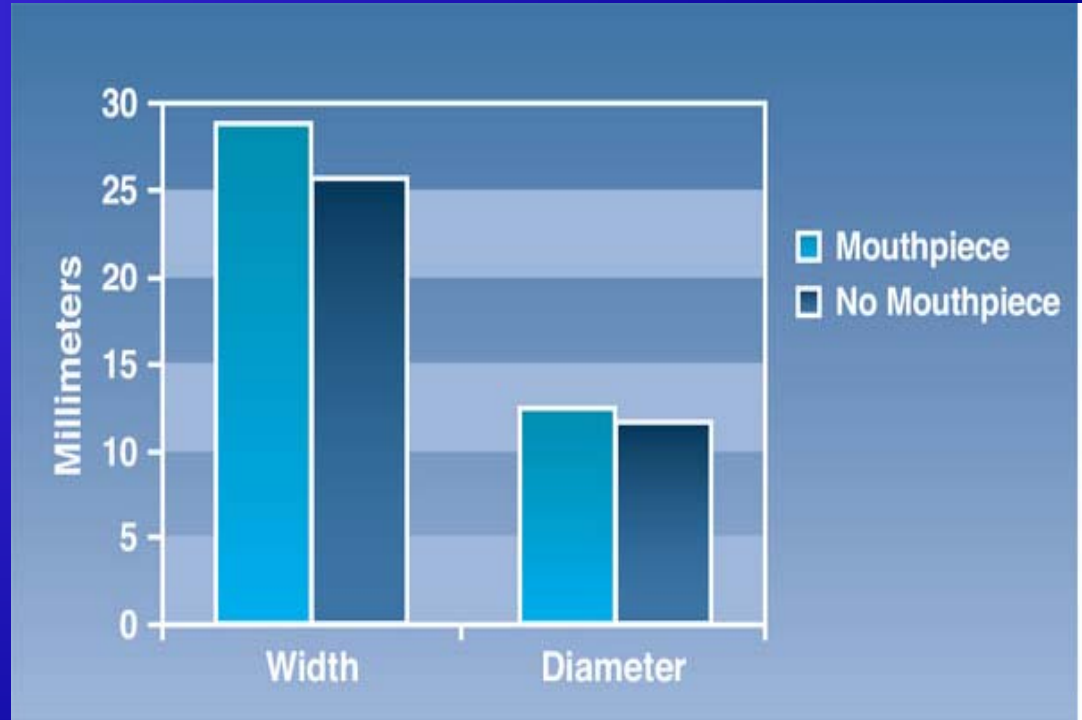
Systemic Influence Special designed MG

Cortisol

Lactic acid



Results: Airway



Mean values of oropharynx width and diameter with and w/o a specially designed appliance:

Airway is significantly increased

Summing up mouthguard effectiveness....

- **“Many do believe that a mouthguard will protect the teeth and even the brain, but without good randomized clinical trial study, the evidence supporting that belief is weak at best.” Sigurdsson, Ped Dent . 2013**
- **One model study NCAA Div I Basketball study. 70,936 athlete exposures. Significantly lowered dental trauma. 3:1.16 times.**

Labella, et al, *Med Sci Sports Exerc* 2002;34;41-44.

**But dental injury
protection
is enough, no?**

**So, Lets make it a rule!!!
Everyone has to wear one!**

What groups can make rules?

- **State Athletic Associations, Little League Intl, USA Hockey, AAU Basketball, ASA, NCAA, All professional leagues, Pop Warner Football, USA Rugby, US Youth Soccer, National Federation of State High School Associations, NAIA, Local Community Organizations of various sports, and many more.....**

What rules are there now?

- **Mouthguards are mandated for Lacrosse, Ice Hockey, Football, Field Hockey**
- **Wrestlers who are wearing orthodontic appliances**
- **Boxing is the only professional sports which mandates mouthguards**

**What about basketball,
soccer, softball, baseball,
volleyball, wrestling, etc?**

**Well, Go ahead , but it ain't
easy.**

For High School and Below Individual States Have the biggest impact.

- **Minnesota**
- **Massachusetts**
- **New Hampshire**
- **Maine**

Mouthguards: The Minnesota Experience



Recommendation

< 10% compliance



Mandate

70-80% compliance

Minnesota New Rule

To require mouthguard use in these sports:

1. Soccer (boys and girls)
2. Volleyball
3. Wrestling
4. Basketball (boys and girls)
5. Baseball
6. Softball

Minnesota Mandate: Chronology

- Medical advisory committee recommendation: 11/1992
- Board considers recommendation 1/24/1993
- Board request coach input 1/24/1993
- Board votes to mandate 6 sports 2/24/1993
- Violent protests erupt
- Board rescinds the mandate 4/1994 and makes a strong recommendation for MG use

Arguments against

Scientific standards:

1. Opponents will demand stringent data to support, but will spout idiotic dribble to support their side
2. Scott M Jensen MD letter is a prime example
 - Aspiration
 - Bacterial transmission

Arguments against

Libertarian issues:

1. Seatbelts
2. Motorcycle helmets
3. Threats of physical violence
 - Death threat against a director in the MSHSL

Arguments against



1. Dentists just want to make lots of money by requiring mouthguard wear
2. Decision makers must have stock in MG companies

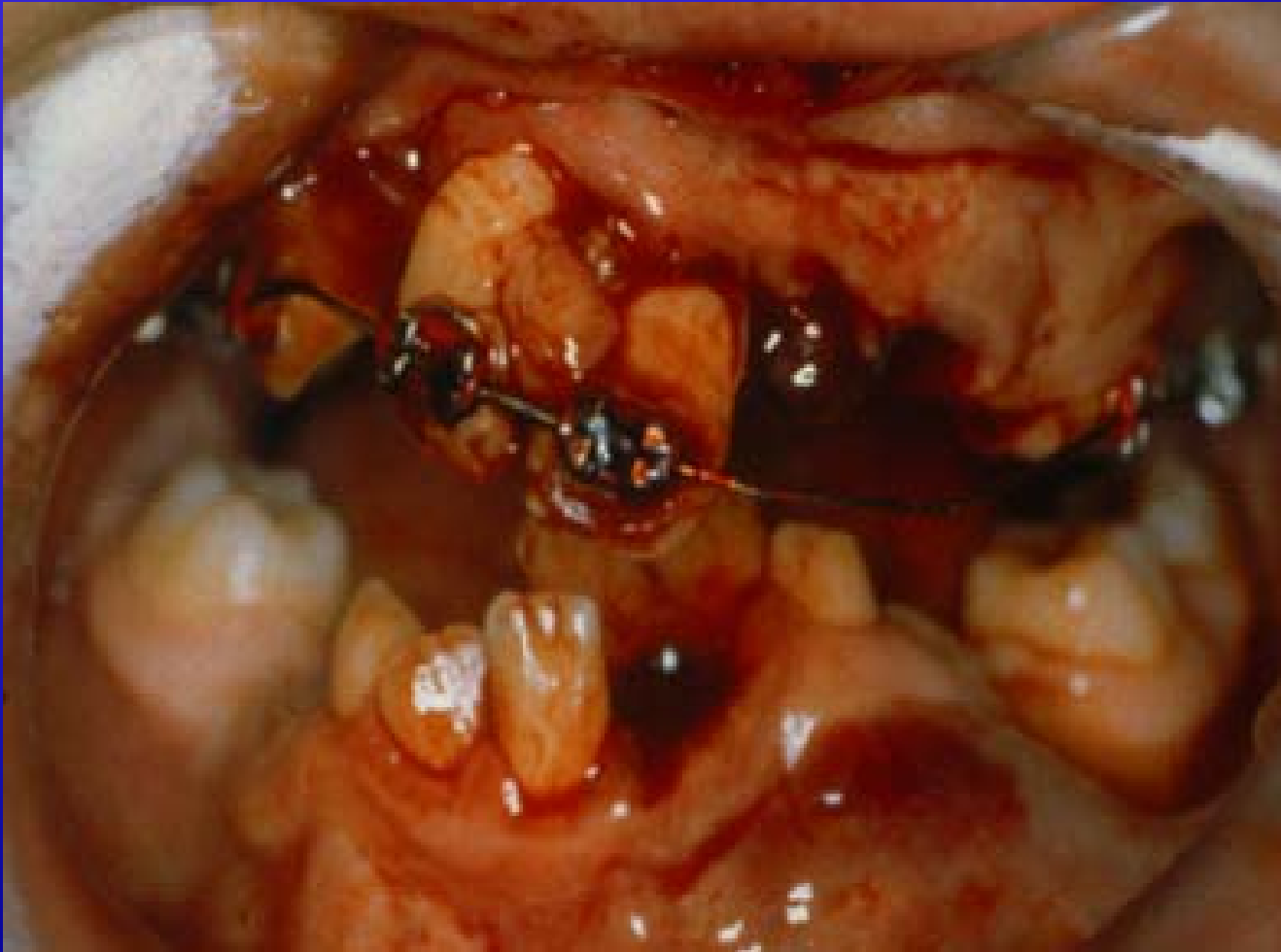
Arguments against



Parent argument: Letter to the MN Governor: Kathy McIntosh from Minnetonka, suggests that MG make for ugly media photos

Is this so ugly Kathy???? Or...

IS THIS UGLY???????



Attitudes on Mouthguards

- Coaches: Extra hassle to deal with
 - I've coached for...
 - Simply just not qualified to judge need
- Athletes: Mirror coaches views
 - Comfort and breathing issues
- Trainers: Most believe in MG use
 - Work most closely with athletes
 - Our greatest ally in this endeavor
 - Minnesota study injury reports
- Parents: Ugly media photos

The Death of the Minnesota Rule

Minnesota State legislature

1. Uninformed : large ego
2. Vocal minority
3. 3-4 female legislators that had previous conflict with MSHSL regarding tennis camps
4. “force of law”

Massachusetts, 2007

Soccer

- **Initially in June 2007 rule was overturned without input from the medical committee.**
- **After the medical committee, the rule was reinstated for two years**

...Basketball

- **Rule changed from a mandate to a strong recommendation**
- **Arguments against were “difficult to speak and breathe”.**

Hygiene issues of mouthguards falling onto the ground/floor

“...lack of education of the coaches, athletic directors and principals.”

Dr. Paul Epstein

New Hampshire 2008

- **Mandates about 18 years ago for soccer and basketball**
- **Questioned the mandate for Basketball.**
- **Maintained the mandate**
- **Must encourage the input of the New Hampshire Dental Community to enhance access to quality protection**

Maine 2009

- **Initiated Soccer mandate in 2009**
- **Since that time, it is attacked yearly**
- **The strong leadership of the Medical Committee upholds the mandate.**

Hockey Rules Committee Plans to Formally Recommend Change to Three-Quarter Visors

[Adam Wodon/Managing ED,
College Hockey News, May 12, 2012](#)

“There are few issues that you will get every coach in college hockey to agree upon. Eliminating the mandate for full face shields is one of them.”



If you want to initiate a rule change, what would our recommendations be?

Education

Educate before you mandate!!!

1. **Dentists:** Dental schools and CE
2. **Parents:** prevention means proactive
3. **Athletes:** Custom MG are comfortable and can be made to improve breathing
4. **Trainers:** Teach dental trauma and prevention
5. **Coaches:** Injuries DO occur; even if you aren't aware of them!!!

Summing up our most important points

- **Millions participate in Sports and they put themselves at risk of injury**
- **It is critical to know how to recognize and manage trauma.**
- **Mouthguards are not all equal but overall they work. But not for everything**
- **Rule changes require cooperation and ongoing diligence**