

Efficacy of mouthguard protection in vitro

Language: English

Authors: Peter Bemelmans, Peter Pfeiffer
School of Dental and Oral Medicine, University at Cologne, Germany

Date/Event/Venue:
10.03.99-13.03.99
77th General Session & Exhibition of the IADR
Vancouver

Introduction

Although sports mouthguards provide protection against trauma, dentoalveolar injuries can still occur with the mouthguard in place.

Objective

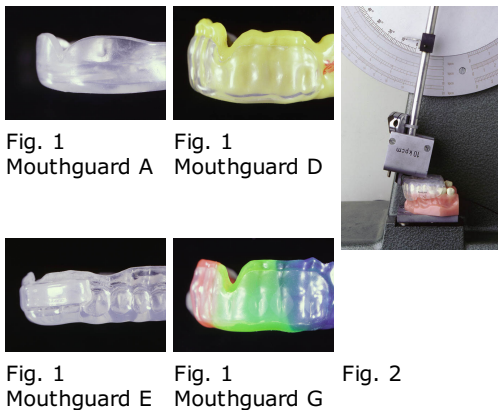
The purpose of this study was to evaluate the effect of mouthguard protection in an in vitro model.

Material and Methods

„Boil and bite“ (A) and custom-fitted mouth-guards [ethylene vinyl acetate (EVA)] laminated with hard [polyvinylchloride (PVC)] (B, D, E, G) or soft labial intermediate EVA layers (C) were fabricated according to manufacturers' instructions (Tab. 1, Fig. 1).

Mouthguards	Type	
U.N.O. Sports, Mouthguard "Fit" (Bremshy, Germany)	Boil and bite	A
Playsafe Heavy Pro (Erkodent, Germany)	Custom fabricated protector	B
Signature Mouthguard Elite (Dreve-Dentamid, Germany)	Custom fabricated protector	C
Signature Mouthguard Professional (Dreve-Dentamid, Germany)	Custom fabricated protector	D
Scheu-Dental-Mouthguard (Scheu-Dental, Germany)	Custom fabricated protector	E
Test Design (layered with silicon)	Custom fabricated protector	F
Test Design (layered with PVC)	Custom fabricated protector	G

Tab.1



A steel ram was dropped onto the mouthguards at the maxillary incisor (21) region (height of 25 cm, 184 N, Fig. 2). The mV-peaks transmitted through the sample (n = 10) were measured at the back of the upper incisor (21) with a strain gauge (ANOVA).

Results

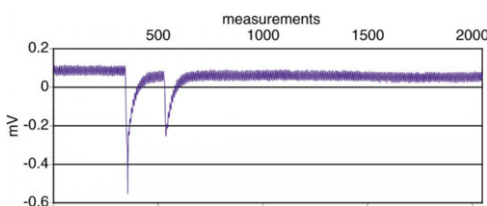


Fig. 3 Loading Mouth guard „Boil and bite“

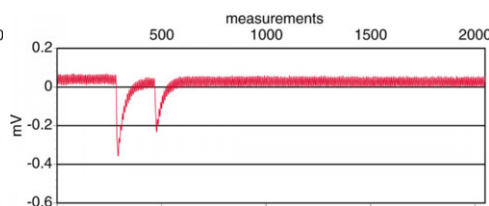


Fig. 4 Loading Mouth guard „Signature Professional“

Mouthguards	Mean, Peak 1	SD
Playsafe Heavy Pro	-0.399 mV	0.034 mV
Signature Mouthguard Elite	-0.403 mV	0.021 mV
Signature Mouthguard Professional	-0.399 mV	0.043 mV
Scheu-Dental-Mouthguard	-0.442 mV	0.068 mV
Test Design (layered with silicon)	-0.445 mV	0.041 mV
Test Design (layered with PVC)	-0.380 mV	0.027 mV

Tab. 2 Mean and SD of peak 1 (Fig. 3, 4)

	Heavy Pro	Elite	Profess.	Scheu	Design silicon	Design PVC
Heavy Pro		ns	ns	***	***	ns
Elite			ns	***	***	ns
Professional				***	***	ns
Scheu					ns	***
Design silicon						***
Design PVC						

Tab. 3 (***) p < 0.05, (ns) p * 0.05, peak 1 (Fig. 3, 4)

Bilaminated mouthguards with hard intermediate PVC layers of 0.8 mm, 1.5 mm or 2 mm thickness showed no significant differences to those of 1.5 mm thick soft intermediate EVA layers (peaks: -0.380 to -0.403 mV). Absorption rate amounted to 33 % compared with the unprotected tooth. „Boil and bite“ and mouthguards layered with silicon or with small hard PVC layers of 1.5 mm thickness demonstrated less absorption (peaks: -0.445 to -0.9 mV) and differed significantly from the other mouthguard systems (p < 0.05, Tab. 3).

Discussion and Conclusions

These in vitro tests demonstrated that mouthguards laminated with soft EVA (1.5 mm thickness) or hard labial PVC (0.8, 1.5 or 2 mm thickness) intermediate layers protected artificial teeth more than those with small hard PVC or with silicon layers.

This Poster was submitted on 29.04.99 by Prof. Dr. Peter Pfeiffer.

Correspondence address:

Prof. Dr. Peter Pfeiffer

Zahnärztl. Prothetik d. Univ.-Klinik Köln

Kerpenerstr. 32

D - 50931 Köln

Poster Faksimile:

1720 **Efficacy of mouthguard protection in vitro**
P. Bemelmanns* and P. Pfeiffer (School of Dental and Oral Medicine, University at Cologne, Germany)

Introduction

Although sports mouthguards provide protection against trauma, dentofacial injuries can still occur with the mouthguard in place. The purpose of this study was to evaluate the effect of mouthguard protection in an in vitro model.

Material and Method

„Boil and bite“ (A) and custom-fitted mouthguards (ethylene vinyl acetate (EVA)) laminated with hard (polyvinylchloride (PVC) (B, D, E, G)) or soft labial intermediate EVA layers (C) were fabricated according to manufacturers' instructions (Tab. 1, Fig. 1).

Mouthguards	Type	
U.S.O. Sports Mouthguard TP® (Germany, Germany)	Boil and bite	A
Playsafe Heavy Pro (Höcker, Germany)	Custom fabricated protector	B
Signature Mouthguard Elite (Desso-Dentanal, Germany)	Custom fabricated protector	C
Signature Mouthguard Professional (Desso-Dentanal, Germany)	Custom fabricated protector	D
Scheu-Dental-Mouthguard (Scheu-Dental, Germany)	Custom fabricated protector	E
Scheu-Dental-Mouthguard (Scheu-Dental, Germany)	Custom fabricated protector	F
Test Design (layered with silicon)	Custom fabricated protector	F
Test Design (layered with PVC)	Custom fabricated protector	G

Fig. 1 Mouthguards A, D, E, G

A steel ram was dropped onto the mouthguard at the mandibular incisor (21 kg force, height of 23 cm, 100 N, Fig. 2). The x/y-peaks generated through the sample (n = 30) were measured at the back of the upper incisor (2) (with a force probe (AN/PVC)).

Results

Fig. 3 Loading Mouth guard „Boil and bite“

Fig. 4 Loading Mouth guard „Signature Professional“

Mouthguards	Mean, Peak 1	SD
Playsafe Heavy Pro	-0.399 mV	0.034 mV
Signature Mouthguard Elite	-0.403 mV	0.021 mV
Signature Mouthguard Professional	-0.399 mV	0.043 mV
Scheu Dental Mouthguard	-0.442 mV	0.068 mV
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Elite			ns	***	***	ns
Professional				***	***	ns
Scheu					ns	***
Design silicon						***
Design PVC						

Tab. 3 (***) p < 0.05, (ns) p ≥ 0.05, peak 1 (Fig. 3, 4)

Bilaminated mouthguards with hard intermediate PVC layers of 0.8 mm, 1.5 mm or 2 mm thickness showed no significant differences to those of 1.5 mm thick soft intermediate EVA layers (peaks: -0.380 to -0.403 mV). Absorption rate amounted to 33 % compared with the unprotected tooth. „Boil and bite“ and mouthguards layered with silicon or with small hard PVC layers of 1.5 mm thickness demonstrated less absorption (peaks: -0.445 to -0.9 mV) and differed significantly from the other mouthguard systems (p < 0.05, Tab. 3).

Conclusions

These in vitro tests demonstrated that mouthguards laminated with soft EVA (1.5 mm thickness) or hard labial PVC (0.8, 1.5 or 2 mm thickness) intermediate layers protected artificial teeth more than those with small hard PVC or with silicon layers.