

CONFIRMED
DECEMBER 2007

Mouthguards for use in sport and recreation — Requirements and test methods

ICS: 13.340.20; 97.220.40

Committees responsible for this Draft for Development

The preparation of this Draft for Development was entrusted by Technical committee PH/3, Protective clothing, to Subcommittee PH/3/11, Protective equipment for sports players, upon which the following bodies were represented:

Amateur Boxing Association
British Association of Field Hockey Equipment Manufacturers
British Dental Association
British Equestrian Trade Association
British Horse Society
British Rubber Manufacturers Association Ltd.
British Safety Industry Federation
British Society for the Study of Prosthetic Dentistry
British Toy and Hobby Association
BSI Testing Services
Consumer Policy Committee of BSI
Dental Laboratories Association Limited
England and Wales Cricket Board
Football Association
Jockey Club
Royal College of Surgeons of England
Rugby Football Union
SATRA Technology Centre
Sports Industries Federation
University of Derby

This Draft for Development, having been prepared under the direction of the Health and Environment Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 July 2001

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Amendments issued since publication

Amd. No.	Date	Comment

The following BSI references relate to the work on this Draft for Development
Committee reference PH/3/11
Draft for comment 99/561864 DC

ISBN 0 580 33288 8

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Foreword

This Draft for Development has been prepared by Subcommittee PH/3/11.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because UK experience needs to be gained. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

A review of this Draft for Development will be carried out not later than 2 years after its publication. Notification of the start of the review period, with a request for the submission of comments from users of this Draft for Development, will be made in an announcement in the appropriate issue of *Update Standards*.

According to the replies received, the responsible BSI Committee will judge whether the Draft for Development can be converted into a British Standard or what other action should be taken.

Observations which it is felt should receive attention before the official call for comments will be welcomed.

These should be sent to the Secretary of BSI Subcommittee PH/3/11 at British Standards House, 389 Chiswick High Road, London W4 4AL.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 19 and a back cover.

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Introduction

Orofacial or dental injuries, which include fracture and displacement of teeth, laceration and splitting of soft tissues and damage to the upper or lower jaw bones, are frequent injuries to unprotected players in high risk sports. These sports include American football, association football, field hockey, ice hockey, lacrosse, martial sports, rugby football, skating and ski jumping. Patterns of injury are related to the nature of the sport. Frequencies between 3 % and 30 % of all injuries have been reported to be in the orofacial or dental regions. In some sports over half the participants have permanent dental injuries. In sports for which the regulatory authorities have made mouth protection mandatory, dental injuries have been reported to be reduced by 60 % and soft tissue mouth injuries by over 80 %.

Other sports such as basketball, cycling, diving, horse riding, squash, gymnastics, parachuting and water polo can be regarded as medium risk sports except for some particular disciplines such as horse racing over jumps which is categorized as high risk.

Most mouthguards are worn on the upper jaw. The anterior teeth and gums are covered, the guard covers the biting surfaces of the upper teeth, and it extends slightly on to the palate. It is held in place by preferably being a close fit to the teeth, and by upward pressure of the lower jaw. Traditionally mouthguards have been supplied in three forms:

- professionally custom-made to fit a particular user;
- ready to wear but without a pre-formed shape and not conforming to the user's mouth; and
- “boil-and-bite” mouthguards which are moulded to the mouth by their user.

Double mouthguards that cover both the upper and lower teeth are designed to give more complete protection than single guards, but some users find a longer period of familiarization is needed before they are acceptable.

Damaging impacts in various sports can be caused directly, by sticks, balls, other players' heads, elbows, knees or boots, sports furniture such as jumps, barriers, posts or the ground, or indirectly, either by similar hard objects or by softer objects striking the lower jaw and causing the lower teeth to hit the upper teeth or trap soft tissue between the teeth. In relatively soft impacts resulting from collisions between players, blows to the lower surface of the mandible are more significant causes of dental injury than frontal blows. Severe head or body impacts that cause large changes in momentum of either jaw can result in damaging impacts between the teeth. This is probably why the full cage face protectors used on ice hockey helmets do not eliminate dental injuries.

Mouthguards are designed to fulfil the following functions:

- a) to support the lips and cheeks on a smooth surface to reduce lacerations and bruising in an impact;
- b) to cushion the anterior teeth against impacts;
- c) to prevent violent contact between upper and lower teeth in impacts;
- d) to provide some support for the lower jaw, and possibly thereby reduce neurological damage from blows to the lower jaw;
- e) to provide an effective means of filling the space left when removable prostheses are taken out;
- f) to provide covering for wires and brackets of orthodontic devices and prevent these from causing localized forces on the teeth, or from causing injuries to the lips in an impact.

Mouthguards can perform these functions in various ways; the following are generally accepted as being important.

- They increase the time to reach a peak force when a hard object hits the teeth, or when the teeth of the two jaws hit each other, by being soft and slightly flexible. The peak force on the teeth is therefore reduced.
- They distribute loads, by filling voids, and therefore reduce peak forces experienced.
- They reduce cuts to the lips by covering the sharp edges and hard surfaces of the teeth.
- They cause a separation of the jaws by having a certain thickness between the teeth, thus they can reduce force transmission through the lower jawbone to the base of the skull.

Certain groups of potential users are at particular risk of injury. These individuals include:

- 1) children whose permanent teeth are still growing and have short roots;
- 2) children with fixed braces;
- 3) children and adults with teeth or jaws that are prominent;
- 4) children and adults who have poor lip coverage of their teeth;
- 5) adults with removable or fixed dentures or other prostheses.

It is important for the regulatory bodies of sports, manufacturers, and suppliers, to be aware of the reasons why most participants would rather not wear a mouthguard. These reasons include discomfort, nausea, interference with breathing and speech, lack of hygiene when it falls out and is put back in, appearance, peer group attitude, and expense. Appropriately designed and made mouthguards can help to minimize these problems.

1 Scope

This Draft for Development specifies the chemical safety, dimensions, physical characteristics and taste and odour characteristics of mouthguards for use in sport and recreation. The physical characteristics of mouthguard boxes for the hygienic storage and transport of mouthguards are also specified.

Annex A gives additional information on, and aid in, the interpretation of statutory requirements for manufacturers and suppliers of mouthguards for use in sports.

This Draft for Development is not applicable to medical device mouthguards which are produced or used on the instructions of medical or dental personnel for the diagnosis, prevention, monitoring, treatment or alleviation of disease.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Draft for Development. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

prEN 13546:1999, *Protective clothing — Hand, arm, chest, abdomen, leg, foot and genital protectors for field hockey goal keepers, and leg protectors for field players — Requirements and test methods.*

3 Terms and definitions

For the purposes of this Draft for Development, the following terms and definitions apply (see also Figure 1).

3.1 mouthguard terms

3.1.1

mouthguard

device worn in the mouth behind the lips covering at least the anterior teeth of one or both jaws and the associated gums

NOTE These devices are also known as “gumshields”.

3.1.2

sports mouthguard

mouthguard worn as personal protective equipment in a sport, recreation or pastime

3.1.3

made-to-measure mouthguard

mouthguard produced by a dentist, dental laboratory or other manufacturer to measurements or impressions taken from the end user

NOTE These mouthguards are also known as “custom-made mouthguards”.

3.1.4

ready-made mouthguard

mouthguard that is supplied in a shaped form in one or more sizes and that is intended to fit the user without being processed to a final shape by the user, apart from minor trimming with a knife

NOTE These mouthguards are also known as “stock” mouthguards.

3.1.5

mouth-formed mouthguard

mouthguard that is adapted to the user in his or her mouth

NOTE This may be done by the user or by another person. The construction method can involve a curing process or heating and moulding of a thermoplastic. These mouthguards are generally supplied as construction kits with instructions. Some of these mouthguards are also known as “boil-and-bite” mouthguards.

3.1.6

finished mouthguard

mouthguard that has been formed, trimmed, smoothed and fitted for a particular user and is ready for use in sport or recreation

3.1.7

mouthguard box

rigid container designed for the storage and transport of a mouthguard

3.1.8

occlusal plate (of a mouthguard)

more or less horizontal part of a mouthguard that separates the occlusal surfaces of the teeth

3.1.9

labial flange (of a mouthguard)

outer (more or less vertical) part of a mouthguard between the lips and the teeth and gums, covering the incisor teeth

NOTE The labial flange is approximately the area of the anterior third of the mouthguard measured from end to end of the occlusal plate.

3.1.10

buccal flange (of a mouthguard)

outer (more or less vertical) part of a mouthguard between the cheeks and the teeth and gums, covering the canine, premolar and molar teeth

3.1.11

lingual flange (of a mouthguard)

inner (more or less vertical) part of a mouthguard between the teeth and gums, and the tongue

3.1.12

palatal flange (of a mouthguard)

continuation of the occlusal plate onto the palate of the upper jaw

3.1.13

dental area (of a flange)

part of a flange in contact with or facing the surfaces of teeth, or where the teeth would be in an edentulous or partially dentate user

3.1.14

gingiva (pl. gingivae)

dense fibrous tissue, covered by mucous membrane that surrounds the necks of the teeth and covers the alveolar processes (tooth sockets) of the jaw bone

NOTE Common name “gum”.

3.1.15

gingival area (of a flange)

part of a flange in contact with, or facing, the soft tissue of the gingivae

3.1.16

edge (of a flange)

furthest limit of a flange running more or less parallel to the long axis of the occlusal plate of the mouthguard

3.1.17

end (of a flange)

furthest posterior limit of a flange running more or less at right angles to the long axis of the occlusal plate of a mouthguard

3.1.18

performance level

number designating the category of protection provided by a mouthguard

3.2 anatomical terms

3.2.1

maxilla

upper jaw bone