Prevention of the Oral Injury by Use of the Mouth Guard

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In modern life, several accidents and/or sports cause injuries to the tooth and maxillofacial bone. The use of a mouth guard or mouth piece can prevent such injuries and the resultant trauma. This study was designed to describe how to individual mouth guards should be constructed as per the clinical indication. Three types of mouth guards are introduced, including the press type, vacuum type, and readymade type; we also describe the materials, procedure, and applications for indication for these mouth guards to prevent tooth fracture or mandible/maxillary bone fracture. We believe that our findings will contribute toward the prevention and protection from tooth fracture or maxillofacial bone fracture, with the use of appropriate mouth guards or mouth pieces for individual cases as per their sports or other activities.

Keywords: oral injury, mouth guard

Introduction
There are several cases of oral trauma because of accidents, such as violence, traffic accidents, falls, exercise, and sports accident, according to the complexity of the modern life pattern. These accidents can cause injuries, such as tooth fracture, tooth luxation or mobility, maxillofacial bone fracture, and temporal-mandibular joint trouble [1].

Such accidents can be prevented or reduced through preventive measures, such as the use of mouth guards and temporomandibular joint (TMJ) protectors with an ear-protection cap while playing sports [2,3].

Mouth guards and mouth pieces are recommended for use while playing sports that involve a high risk of oral trauma, such as boxing and football training; protective ear caps are recommended while playing baseball [4-7]. Thus, there is a need to understand how to make mouth guards for individual subjects to prevent dangerous accidents [8].

Figure 1. Ready-made type.
Body

1. Classification of the mouth guard

The types of mouth guards are classified as 2 types as the ready-made type and custom made type. Generally, the materials for mouth guard would be latex rubber-based or plastic ingredients materials, with different colors [3].

1) Ready-made mouth guard (Figure 1)

It has made as 3 types by size as large, medium and small and divided as 2 types as a stock type and mouth form type.

(1) Stock type: Use the U-shaped rubber form by its-self, without reforming it.

(2) Mouth form type: Reforming the ready-made type by use of hot water or heat for softening and cutting the unnecessary part on the edge.

2) Custom made type mouth guard (Figure 2)

Custom type is defined as producing it from the latex rubber materials according to the individual patient’s oral cavity form, and classified as 3 types by production technique as pressure type, vacuum type and lost wax type.

(1) Pressure type: Produce it with high pressure and get such characteristics as good adaptability and good comfortable for wear, to protect teeth from the outer force for prevention of tooth fracture.

(2) Vacuum type: Produce the mouth guard by use of the Omni vacuum system as a vacuum unit. It has such merits as easy production and relatively cheap to distribute widely for skating players. It can be a little bit worse for the prevention effect for outer force because of the relatively thin layer of the materials at the teeth part than the pressure type.

(3) Lost wax type: This type is made from the individual wax-up after impression taking and stone model production, in order to insert the rubber latex material into the investment...
mold and to burn out the wax pattern for a mouth guard. It has such merits for adaptable for individual patient’s oral cavity but a disadvantage for a long time and excessive efforts for production.

2. Production of mouth guard [9]

1) Pre-treatment

It needed to treat dental caries and prosthodontic rehabilitation before the mouth guard application. Periodontal treatment is also needed and it should be considered and pre-education in case of TMJ trouble and malocclusion to wear the mouth guard application.

2) Mouth guard design

The mouth guard is applied on the upper teeth generally except a special case as a severe anterior crossbite. The thickness of the mouth guard is a little bit thick in anterior teeth but relatively shallow in posterior teeth, even though more comfortable in less thickness. It could be different in thickness of the mouth guard according to the different spots and 2 or 3 layers of the rubber plate will be used for heavy fighting sports players.

The following two types of a mouth guard as press type and the vacuum type are prevalently used in clinical (Figure 3, 4).

3) Production of the pressure type mouth guard [10]

(1) Out-line form design in the frontal area: widely sized design for covering the anterior teeth in the frontal area in order to enhance the prevention effect (Figure 5).

(2) Out-line form in posterior teeth area: design as covering at the central area of buccal surface in order to establish the occlusal relationship.

(3) Out-line form on palatal side: Draw the line along the center of the crown or cervical area at the frontal area. Make a

![Figure 6. Pre-heating of the material.](image)

![Figure 7. Heating for 2-3 minutes.](image)

![Figure 8. Press for 6.5 atmospheric pressure.](image)

![Figure 9. Remove from the model.](image)
notch at a labial frenum.

(4) Design for the posterior area: Extend the line till the end of the second molar in case of no existence of the third molar.

(5) Apply for the lubricant on the model: In order to easy separation of the materials from the model.

(6) Heating and softening: 2 or 3 minute’s heating for softening of the material is needed after a minute’s pre-heating (Figure 6).

(7) Pressure: Pressure would be begun at the time for flow down the laminate material for 1-2 cm and pressure with 6.5 atmospheric pressure to adhere the laminate to the model out-form (Figure 7, 8).

(8) Removal: Remove the laminate from the model after cooling the temperature, with care for not distortion of the production (Figure 9).

(9) Production of the re-model: Make a re-model through pouring the plaster into the inner side of the mouth guard (Figure 10).

(10) Mounting on the articulator: Mounting the model on the articulator by use of the face bow to adjust the occlusion and no bite state on the end of the posterior tooth (Figure 11).
(11) Correction and reform of the mouth guard: Correction of the outline form of the mouth guard with heat bladed knife or ultrasonic cutter and finishing the detailed area with a diamond point (Figure 12, 13).

(12) Occlusal adjustment: Occlusal adjustment would be done by use of the torch lamp or heat bladed knife with pressing the occlusal bite mark and cutting the excessive area before polishing (Figure 14).

(13) Preparation for the second layer of the laminate: The outer layer of the laminate would be slightly cut in order to coating with a secondary layer of the laminate on the base mouth guide surface. It can be possible to insert the small name tag paper between the first and second layers of the laminate plate (Figure 15).

(14) Heating for secondary laminate material: Heating the secondary laminate plate to softening after pre-heating for a minute and then, it will be on the first laminate mouth guard plate (Figure 16).

(15) Secondary pressure: Adhere secondary laminate plate to the first laminate plate with the press for 6.5 of atmospheric pressure, and cooling it for separating from the model (Figure 17).

(16) Polishing: cutting off the excessive area of the mouth guard and make a notch at the frenum area to diminish the foreign body sensation. Adjust the bite mark with 5 mm left and polishing it by rubbing with the Chloroform gauge or painting with the finishing liquid (Figure 18, 19).

(17) Delivery a mouth guard to the patient: Deliver the mouth guard to the patient in consideration of the occlusion and educate how to use it (Figure 20).

4) Production of vacuum type mouth guard
Vacuum type of mouth guard is relatively easy and simple to produce and generally used in clinical.
(1) Preparation: Such unit or materials as Omni-vacuum unit, flat form sheet, and impression material and tray, marker pencil are needed. Laminate flat form sheet is prepared as 5 mm thickness in frontal teeth area and 4 mm of thickness in the posterior area as tapered form sheet plate (Figure 4).

(2) Out-line form: Draw the outline form on the stone model from impression taking (Figure 21).

(3) Heating: Turn on the heat switch of the Omni vacuum type to heat for 3 minutes’ pre-heating and put the flat form sheet on the vacuum to soften by heating and then, heat again on the backside by turn it inside out (Figure 22).

(4) Setting: Put the laminate sheet plate on the upper side of the Omni vacuum unit and fix the dental model under the unit at the model position.

(5) Heating and softening: Heating for 2 or 3 minutes to softening the laminate plate extended for 2 cm of length (Figure 23).

(6) Pressure: Press it with the handle of the vacuum unit and cooling it enough for 3-5 minutes, and then put it out from the unit (Figure 24).

(7) Marginal cutting: Cutting the margin according to the
(8) Removal from the model and polishing: Remove the mouth guard from the model and polishing or correction of it marginal line by use of a heating blade knife (Figure 25).

(9) Occlusal adjustment: Bite check on the articulator after re-heating and biting for occlusal bite check with carbon paper with the diamond point or rubber wheel (Figure 26, 27).
for a bite mark. Bite of the mouth guard would be 0.5-1 mm of higher than normal occlusion, in consideration of the thickness of the laminate sheet plate (Figure 28).

(10) Cleansing: Rubbing the surface of the mouth guard with Chloroform gauge and painting with the finishing liquid for a few minutes (Figure 29).

(11) Apply: Deliver the mouth guard to the patient and instruction for use (Figure 30).

3. Selection of mouth guard type

The different types of mouth guards can be used according to different sports or works. It will be introduced the proper type of mouth guard for each sport or works as follows.

1) Sports leisure

Press type of mouth guard would be recommended on such leisure or professional sports as in-line skating, cycling, surfing or rafting (Figure 31).

2) Ice hockey

On such sports as often fall down accident happen, it would be recommended the pressure type with handle type to put it on easily with the thick glove (Figure 32).

3) Violent sports

It is recommended to wear the mouth guard formed as all labial and buccal surface covered shaped with thick type (Figure 33).

4) Golf, baseball, soft-ball

Vacuum type mouth guard without anterior surface would be recommended for such sports as golf, baseball or softball play which can be worried about the clenching force from the excessive biting on the sports playing (Figure 34, 35).

5) General sports

The general form of the vacuum type mouth guard is recom-
mended for general sports as playing with the ball, health training, horizontal bar player, bike riding, or motorcycle riding as a general sports player, because of easy and simple production with cheap price and colorful design (Figure 36).

6) Bruxism and snoring protection
   In case of severe bruxism or snoring, the mouth guide with a unified form of upper and the lower anterior portion would be available to prevent the snoring (Figure 37, 38).

Conclusion

It is necessary for people who play dangerous sports to wear mouth guards in order to prevent accidental injury to the bone and teeth. Thus, the use of mouth guards or mouth pieces should be recommended during such sports or leisure that involves a risk of traumatic mouth injury. The press type of mouth guard with anterior open form is recommended for leisure-type sports activities, such as golf and baseball; for other activities, such as inline skating bike riding, motor cycling, and surfing, the vacuum type is recommended. Moreover, a
mouth piece with unified form with upper and lower anterior part can also be recommended to resolve the issue of snoring.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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