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Clinical Effectiveness of a Custom Faceguard for a Futsal Player Injured with a Nasal Bone Fracture for Early and Safe Return: A Case Report

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Key words: sports injury, medical faceguard, maxillofacial injury, nasal bone fracture

Abstract:

Futsal is a five-a-side version of football played on a smaller pitch. In futsal, most injuries affect the lower extremity (70%), followed by the head and neck (13%), and the incidence of concussion is reportedly 3.6-times higher than in football. Wearing a faceguard (FG) after maxillofacial injury can allow early, safe return to sports after injury, and the demand for FGs has been rising annually. This study examined the clinical effectiveness of a FG customized for a 30-year-old male futsal player in a top Japanese league team following nasal bone fracture. We also investigated the clinical assessment of the FG by the player, to obtain information for further development of FGs for futsal players. First, a case was made. Support areas of the FG were assigned to the frontal region and zygomatic arch. The eyes and nasal apex were left as uncovered as possible to minimize effects on the field of vision. A 3.2-mm-thick hard thermoplastic material was then softened and molded over the cast with light finger pressure. Cushioning materials were adhered to both inner and outer surfaces of the thermoplastic material. The FG was secured to the face using two stretch bands with hook-and-loop fasteners. Until fracture healing was confirmed after 3 weeks, the patient used the FG 15 times in practice and once in a preseason match. After using the FG, a questionnaire with 11-point rating scales was administered, asking: 1) about age, sex, and type of sports; 2) about frequency of and dissatisfaction with use; 3) about protective ability and comfort of FG use; and 4) about visual field in 4 directions (upper, lower, inside and outside). While protection ability and comfort appeared good with FG use, more attention in the design may need to be paid to fit and the lower visual field.

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Introduction

Futsal is a five-a-side version of football played on a smaller pitch, usually indoors. The sport is played by over a million people worldwide[1] and is growing in popularity in Japan, where the Japan Futsal League (F. League) was established as the top Japanese futsal league in only 2007. Little information is available regarding injury risks in futsal[2], while large amounts of information have been published regarding injury risks in soccer[3-6].

According to a study that analyzed the incidences and characteristics of injury during the past three Futsal World Cups[2], more injuries were caused by non-contact with other players in futsal games than in football games[4-6]. In futsal, most injuries affect the lower extremity (70%), followed by the head and neck (13%), and the incidence of concussions is reportedly 3.6-times higher than in football. These reports show that futsal players are at potentially greater risk of maxillofacial injuries.

Recently, the utility of wearing a medical faceguard (FG) to allow early and safe return to exercises and sports after maxillofacial injury in contact sports has been widely recognized by players, and the demand for FGs has continued to rise each year[7-16]. The design of the FG needs to consider the injured region, type of sport, level of competition and position of the player[17]. However, few case reports have illustrated the demands of FG design for futsal players. One purpose of this study was to indicate the clinical effectiveness of a FG customized for a futsal player in a top Japanese league team who sustained a nasal bone fracture. Another purpose was to investigate the clinical assessment of the FG by the player and thus obtain information for optimum development of FGs for futsal players.

Case

Patient: A futsal player (male, 30 years old) belonging to a team in the F. League (*Fig.* 1)

First visit to our clinic: June 24, 2008

Chief complaint: He wanted a FG to allow early and safe return to futsal training and games, as the league season was about to commence.

Current medical history:

June 15, 2008: He broke his nasal bone in a collision with the heel of another player during an official game.

June 21, 2008: As he did not undergo any operations, he was referred to our clinic by his team doctors for the design and manufacture of protective equipment to allow a safe return to play.

Course of Treatment

Facial impression taking (June 23, 2008) (*Fig.* 2)

To prepare a facial cast, a facial impression was taken using alginate impression material (Aroma Fine DF III™; GC, Tokyo, Japan) and an impression plaster material (Xanthano™; Bayer Dental, Leverkussen, Germany).

Fabrication of custom FG

The moulage was filled with Type IV dental stone (New Fujirock™; GC) to make the facial cast. To provide adequate space between the injured area and the FG, the injured area on the facial cast was covered with a layer of silicone material for dental laboratory use (Lab Silicone™; Shofu, Kyoto, Japan) roughly 5 mm thick. Fig. 3 shows the outline of the FG. Support areas of the FG were assigned to the frontal region and zygomatic arch. The eyes and nasal apex were left as uncovered as possible to minimize effects on the field of vision.

A 3.2-mm-thick thermoplastic hard-sheet

material (Aquaplast™; Patterson Medical Holdings, Bolingbrook, IL, USA) was softened in a hot water bath (70-75°C). This material was molded over the cast with light finger pressure (*Fig.* 4a,b). Cushioning materials (Neoprene™, inner thickness=3.2 mm, outer thickness=1.6 mm; Patterson Medical Holdings) were adhered to the inner and outer surfaces of the trimmed thermoplastic materials using Aronalpha™ super glue (Toagosei, Tokyo, Japan). The outline edges of the cushioning liner materials of the FG were sewn with a 5-mm stitch width. The FG was secured to the face of the patient using two stretch bands with hook-and-loop fasteners (Velcro™ sew-on tape; Velcro USA, Manchester, NH, USA) (*Fig.* 5a,b).

Fig. 1 The frontal view at the first visit.
Fig. 2a,b Facial moulage with irreversible hydrocolloid impression material and impression plaster material.

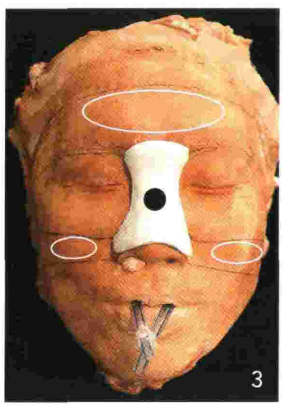
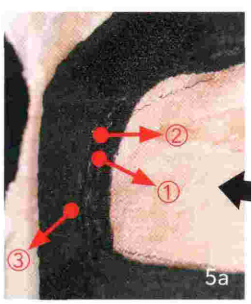


Fig. 3 Outline of the faceguard.
○: Support area
●: To provide adequate space between injured area and FG, covered the injured area on the facial cast with a layer of silicone material roughly 5mm thick.

Fig. 4a,b The thermoplastic material of faceguard.
Molded and trimmed to the desired outline drawn on the facial cast.



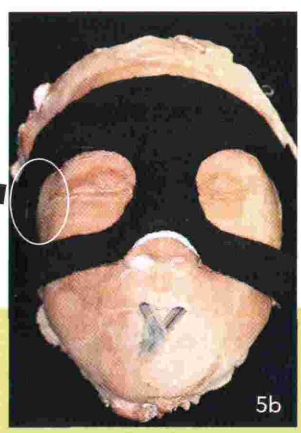


Fig. 5a,b FG design.
①Lining the inner surface of the FG with cushioning material
②Hard thermoplastic material
③Covering the outer surface of FG with cushioning material

Wearing the FG (June 26, 2008) (*Fig.* 6a~c)

We ascertained the suitability of the FG for the facial surface, and checked and adjusted the length of the stretch bands. The patient was allowed to return to play while wearing FG after the first day.

Follow-up after Comeback

Over the course of 3 weeks, the patient used the FG 15 times at practice and once in a preseason match. Fracture healing was confirmed by team doctors on July 9, 2008. He was subsequently allowed to play futsal without wearing the FG.

Clinical Assessment

After using the FG, a questionnaire survey with 11-point rating scales was administered. The questionnaire was structured into four parts: 1) questions about age, sex, and type of sports; 2) questions about frequency of use and presence of any dissatisfaction; 3) questions about protective ability and comfort of FG use; and 4) evaluation about visual field in 4 directions (upper, lower, inside and outside).

The patient was satisfied with the protective ability of the FG, but was dissatisfied with the poor fit, as the FG tended to slip off while playing futsal (*Fig.* 7). Evaluation scores for visual field were high for the upper and inner sides, but low for the lower side (*Fig.* 8).

Fig. 6a~c Fitting of faceguard.

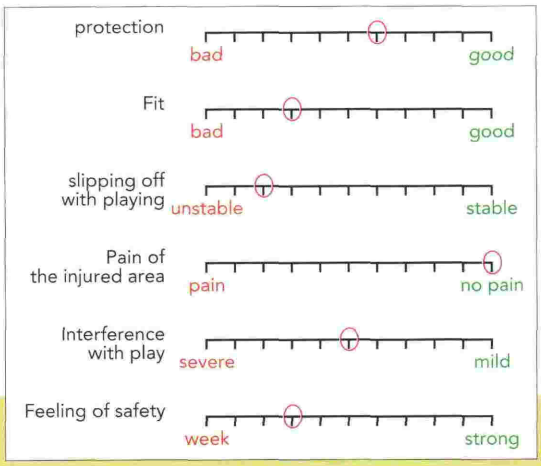


Fig. 7 Evaluation about protection ability and feeling of FG use with 11-point rating scales.

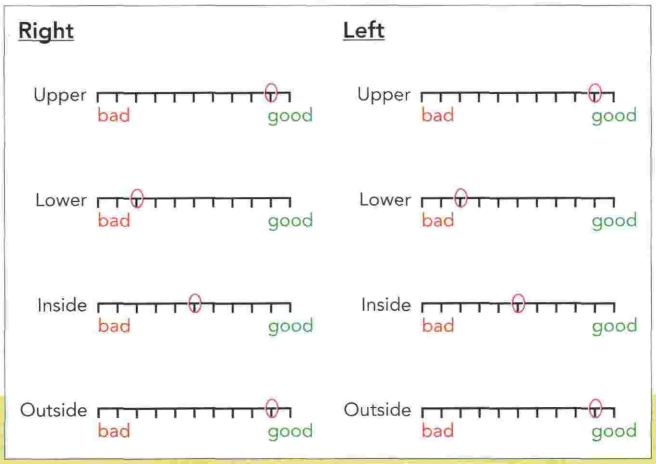


Fig. 8 Evaluation about visual field when using FG with 11-point rating scales.

Discussion

A futsal court (38-42 × 20-25 m for international matches)[18] is slightly larger than a basketball court (28 × 15 m)[19], and smaller than a football field (100-110 × 64-75 m for international matches)[20]. Players in futsal games are thus in much closer proximity to each other than in football games. The location and diagnosis of injuries is similar between futsal and football, according to a previous report[2-6]. Although contact play in futsal had been theoretically limited in comparison with football, futsal players had already been reported to be at greater risk of maxillofacial injury, while fewer injuries were caused by contact with another player or foul play in futsal than in football[2]. And more, video analysis of the head and/or neck injury situation has already shown that unfair use of the arm to tackle the opposing player. Based on the results of the reports, the referees of the 2006 FIFA World Cup™ were encouraged to severely sanction injurious fouls. In the 2006 FIFA World Cup™, the total number of head injuries dropped even to almost half compared with in the 2002 FIFA World Cup™ [3,6]. Future studies should investigate injury mechanisms in futsal using video analysis to reduce the incidence of injury[2].

Furthermore, no differences between futsal and football have been identified after a revision of the 2010 Futsal Laws of Game[21]. This means that the risk of maxillofacial injuries in futsal will be elevated in the future. Showing the clinical effectiveness of FGs is very important for futsal players who sustain a maxillofacial fracture.

Design of the FG

By the time of the first visit, the patient already had no pressure pain at the nasal apex, as the peak inflammatory period in the process of bone fracture healing had already passed. The restoration period was considered to be underway, overlapping with the inflammation period in the healing process. The risk of displacement and/or bleeding on slight contact remained for the restoration period, as strength and stability of the injured bone remained lacking. According to Article 6 of the Futsal Laws of the Game[18], referees must ensure that any player bleeding from a wound leaves the pitch. The player may only return after the bleeding has stopped. For these reasons, we selected a design to provide adequate space between the nasal bone area and FG without covering the apex of the nose.

According to previous research about the impact absorption ability of the FG under an impact load[22], a combination of hard thermoplastic material and soft cushioning material can provide remarkable shock-absorbing ability. To further improve the capacity for shock absorption, lining the inner surface of the hard thermoplastic material with cushioning material is more effective than providing the cushioning material on the outer surface of the hard thermoplastic material.

Article 4 of the Futsal Laws of the Game states that a player may use equipment other than the basic equipment[18], provided that the sole purpose is to provide physical protection and that no danger is posed to the wearer or any other players. Modern protective equipment, such as headgear, facemasks and knee and arm protectors made of soft, lightweight padded material are not considered dangerous and are therefore permitted. The outer surface of the FG thus had to be covered in soft material to prevent injury to the wearer or other players. In addition, if an item of clothing or equipment that has been inspected by ref-

erees at the start of a match and determined not to be dangerous becomes dangerous or is used in a dangerous manner during the match, its use will no longer be allowed in the futsal game. This means that the FG also required sufficient durability[20].

Clinical Assessment

Some differences in evaluation scores for the visual field while wearing the FG were seen compared with those by football players who had sustained nasal bone fracture. Generally, scores for the lower side in football players were not so low[17], while his lowest evaluation scores were for the lower side, and the scores for other side except the lower side were not so low. Although demands in terms of visual field differ according to the specific sport, position and level of competition, attention may need to be paid to securing the lower visual field when applying FGs to futsal players. One reason may be that compared with football, futsal is often played near the pitch level.

Conclusion

This study aimed to show the clinical effectiveness of a FG customized to a futsal player who sustained a nasal bone fracture. Clinical assessments of the custom FG by the player were investigated to obtain some information for further development of the optimum FG for futsal players. Results were as follows:

1) He used the FG for 3 weeks until the fracture healed without re-injury, including 15 times at practice and once in a preseason match.

2) Assessments about protection ability and comfort with FG use appeared sufficient. When we apply FGs to futsal players, more attention in the design may need to be paid to outlines concerning the lower visual field.

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