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Research Article

An Evaluation of Compliance in the Use of Mouth Protection Devices (Mgs) in a Group of Young Athletes

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- Dental injuries; Mouth guard; Sports injuries; Sports dentistry

Abstract

Introduction: The use of mouth guards is strongly recommended in a number of sports, and there are numerous works in the relevant literature that stress the effectiveness and importance of using personal Mouth Guards (M.Gs.) It is also common knowledge that persuading people, especially young children, to use these protective devices regularly is not an easy task.

Aim: This study has aimed to establish whether or not the use of an electronic system measuring frequency of use, installed directly in the Mouth guard, will encourage young sportspeople to use these devices without the need for continuous motivational reinforcement The appliance used is known as Thera Mon and is a Class I Medical Device. Thera Mon is an electronic system which provides constant documentation of the actual wearing time of removable appliances.

Materials and methods: We carried out a preliminary observational study on the behavior manifested by a group of 12 young males who wore mouth guards equipped with the electronic measuring system four times a week for nine months, without any external motivational reinforcement being provided. The procedure used to produce the mouth-guards was the traditional Tecnica Erkodent for the Medium three-layer model of the Play safe teeth-guard line.

Results: We found that all the young sports-people had remained in the screening program. Specifically, 7 participants had continued to use their mouth guards regularly (4 times a week), 3 had used their devices not more than three times a week and 2 used theirs only during competition events.

Conclusion: These findings show that the use of these devices does not influence participants' attitude to wearing them. Indeed, they demonstrated a willingness to use them regularly and we believe that particularly in the case of young children who practice sports, it is a method that can replace or provide a valid alternative to the established motivational reinforcement methods that may at times be unreliable.

ABBREVIATIONS

MG: Mouth Guard

INTRODUCTION

Mouth Guards are flexible devices placed within the oral cavity to protect teeth and soft tissues against injuries. Currently, the following M.G. are available: (1) stock mouth guards, prefabricated in different sizes; (2) Standard self –adapted M.G. like boil and bite mouth guards, in which the material is immersed in heated water for direct impression of the dental arch, and (3) Custom-fitted mouth guards, manufactured by the dentist based on the model of the athlete's mouth .

The use of mouth guard (MG) is strongly recommended in a number of sports where frequent physical contacts between players are common [1, 2]. Dental traumas have an incidence between 25 and 30% in the teen population practicing sports activities [3]. Basketball is one of those sports activities classified by the FDI as a medium-risk activity for dental trauma (in the same category of handball, soccer, squash and water polo). Contacts between players are very frequent, and the low level of experience, like in young group of athletes, contributes to increase the risk of trauma. The regular use of a mouth guard during the games should always be encouraged [4,5].

It is a recommendation which should always be respected in youngsters in the 8-16 age range, who compete in sports in which there is a high frequency of dental traumas that can have serious and permanent consequences (avulsion, root and crown-root fractures) [3,5,6]. There are a number of published works that confirm the importance of using personal Mouth Guards due to their effectiveness in reducing or eliminating the consequences that direct or indirect traumas can produce on the dental apparatus of young sports-people [7,8].

It is well known that young children are not easily persuaded to regularly use intraoral protective appliances either in training or in competition and the literature informs us of the quick loss of interest in the use of these devices over time [9-12].

Recent studies have focused on this problem and have emphasized the importance of giving motivational reinforcement to use these appliances throughout the sporting season; with groups of adolescents the best results have been obtained by coaches and/or trainers that provide constant motivational support pressing the athletes about the use of the mouth guard both during the training sessions and the competitions [13-16].

This study has aimed to verify whether or not the use of an electronic control system measuring frequency of use, applied directly inside the intraoral protective device, will induce young children who practice sports to use these devices without the need for constant motivational reinforcement. The method has been successfully trialed in dental removable appliance therapy [17] and it is believed that the same positive results may be obtained with their use in mouth guards. The appliance, known as Thera Mon, is a Class I Medical Device; it is an electronic system which provides constant documentation of the actual wearing time of removable appliances.

Preparing and installing the appliance involves innovation in design and specialist working methods by the dental technicians. The control device must be placed inside the mouth guard without obstructing or disturbing the normal routine functioning of the child's mouth apparatus, which is essential to ensure that the young sportspeople can wear the mouth guards when training or competing, without any negative psycho-behavioural effects that may dissuade them from using their mouth guards.

This Study aims of ascertain if the use of such control systems have a positive effect on motivation and have little or no negative local effects or psycho-emotional effects on the young athletes during the use of their M.Gs.

MATERIALS AND METHODS

The study took place at the Department of Dental Science at the University of Cagliari between the months of December 2014 and October 2015.

The study sample selected comprised 12 young males between the ages of 13 and 15, who all play basketball at competition level and who train 4/5 times a week.

The first inclusion criteria was complete eruption of the permanent teeth: This limit was due to the production of a laminated custom-made mouth guard for each athlete, whose production requires the complete eruption of the teeth for a correct molding of the dental arch. The athletes wearing multi-bracket braces on the upper and lower dental arches were also excluded from this study.

All relevant information was also given to the parents or next of kin of the young players as well as to the training and medical staff overseeing the club's sports activities.

The children participating and their parents were told about the device equipped with a system of electronic control measuring frequency of use, and it was clearly explained that the appliance is totally harmless, since no radiation is emitted, and captured data can only be retrieved as long as the sensor (splint/brace) is positioned within the magnetic field of the Reading station. The wearer feels no sensation of an obstruction; the consent of the participants and their parents was obtained for the control period of nine months.

The present work involved the preparation of 12 personal Mouth Guards, created following the Play Safe technique (Erkodent-Germany) and the protocols in place at the University of Cagliari and the Orthofan Technical Laboratory (Villa Lempa (Te) – Italy).

The protocol requires a careful postural and occlusal analysis of the subjects participating in the research experiment. All protective appliances were provided free of charge. The screening process, coordinated by the University of Cagliari's Sports Odontology research Centre, consisted of three assessments in which the young participants were given a thorough oral and postural examination on a stabilizing metric platform (Axa Microlab- Vimercate-- Italy).

Subsequently two alginate impressions of the superior dental arch and inferior dental arch were prepared with the use of standard impressions trays. A wax occlusal rim in maximum intercuspidation was prepared ,so a hardened plaster models were produced and were sent to the(Orthofan Technical centre) where individual devices were made to fit the characteristics chosen by each of the young participants. At this point the technician could install the control device.

The Thera Mon method of electronic measuring uses a Micro sensor that measures and stores the actual wearing time of removable appliances.

The Thera Mon reading station (The TheraMon® reading station ensures the communication between the micro sensor and the outer world and will be connected via USB cable to the PC or laptop) reads the content of the sensor memory and transfers the data to the PC and the Evaluation Software activates the Technicians software that tests sensors before, during and after embedding. The software evaluates wearing time and presents data in an easily understandable graph on the PC screen. The above equipment is produced by MC Technology GmbH (Engineer Gerhard Gschladt - Austria) and is distributed in Italy by the company Dentaurum (Bologna - Italy), which supplied the device to the research centre to carry out the screening process.

Assembling the measuring device was the first problem encountered because the microchip (Size: 9 x 13 x 4.5 mm) incorporated into the mouth guard (Figure 1) does not tolerate temperatures in excess of 70°, thus an increase leading to a difference of 40°/90° means the system will not function and will therefore compromise the study.

A modified metal duplicate (Figure 2) was therefore made and a small flap was positioned opposite the microchip battery to allow, if necessary, for removal or substitution of the mouth guard's microchip using the lost wax casting method.

The procedure used to produce the Mouth Guards was the traditional Tecnica Erkodent (• Erich Kopp GmbH - Pfalzgrafenweiler • Germany) method for the Play Safe mouth guard, so all 3 PLAYSAFE medium layers prepared were molded at high temperature and at 6 atmospheres until the devices were ready.

Figure 1 Original Microchip Thera Mon.

Figure 2 View of the duplicate placed on the model.

Once the high pressure molding is completed, but before the finishing touches are made, the duplicate metal microchip can be removed (Figure 3) and the Thera Mon microchip, already activated by the laboratory software, can be inserted into the previously created niche (Figure 4). A small EVA sheet is then adapted to the same thickness used before, and a heated tool is used to hermetically seal all the edges of the chip (Figure 5). After the five days required perfecting the MGs, they were sent to the University Lab and the participants were called in to receive their protective appliances (Figure 6).

After testing the mouth guards for occlusal adjustment (only 3 MGs required slight further finishing to optimum occlusal functioning), the participants began using their appliances in training.

Timing: The timings of the study consisted in the start of the use of the M.G. (T0) followed by clinical checkups at 1,3, 6 and 9 months (T1, T2 , T3 and T4). The observational period started after a week, which was needed to verify the correct adaptation of the MGs and their wear ability by the young participants.

Having registered the appliance in the dentist software station for gathering patient data and assigning it to the appliance and for initial automatic readout, experimentation time (T0) could begin.

After 30 days (T1) the participants were recalled and interviewed. Only two of them said they could feel the obstruction of the mouth guard, specifically in the functioning of the flap; the problem was resolved with small adjustments and they continued to use the appliance.

Observation then continued with controls at time T2 (three months of use) at the end of T3 (six months of use) and finally T4 (after nine months of use), after which we were able to draw our conclusions on the observational phase of our study.

During the control phases, participants were interviewed to ascertain whether or not the appliances created any discomfort, and we collected data from the positioning of the device in the reading station, from the transfer of wearing data and analysis of retrieved actual patient wearing time.

Figure 3 Removal of the metal duplicate.

Figure 4 Microchip TheraMon in position.

Figure 5 View of the sealing system for the microchip inside the mouth guard.

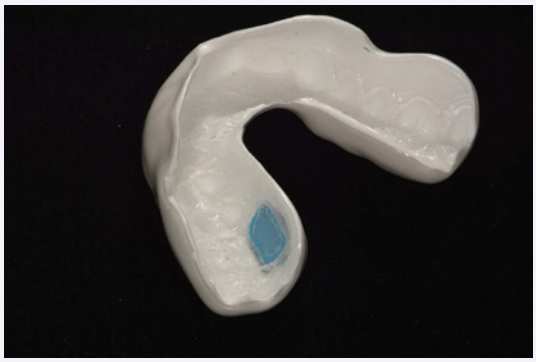

Figure 6 Mouth guard finalized with microchips.

RESULTS AND DISCUSSION

As regards the results obtained during the observation period, the first result to note is that all the young participants remained in the study throughout the control period (for 9 months to T4).

Individual records on M.G. use were monitored and analysed through Reading station data. At T1, all 12 participants had regularly worn their M.G. both in training and in competition (values were calculated when the device was used at least four times a week). At T2 (i.e. after three months of use) 8 participants had continued to use the device regularly (at least four times a week) while 4 athletes had worn the device slightly less regularly (three times a week). At T3 (after six months of use), 7 participants had continued to use the device regularly (at least four times a week), 3 had used their devices not more than three times a week and 2 athletes had used theirs only during competition events.

On completion of the observational phase T4 (after 9 months of use), the above was confirmed: 7 participants had continued to use their mouth guards regularly, 3 had used their devices not more than three times a week and 2 used theirs only during competition events.

In sum, none of the participants abandoned using their devices during the observation phases, and a high percentage (7 out of 12 participants) wore their appliances regularly without the need for continual motivational reinforcement.

The results obtained are interesting (even if preliminary) when compared to previous studies[16,18] where the sample of participants were of comparable age and sex [9,10] in particularly with those of a recent and similar study carried out by Spinas [13] on a group of 15 young males observed for 6 and 12 months, in which there was a high percentage of withdrawals from the group that were given no motivational reinforcement (13 out of 15 quit the project,i.e.80% of participants), and a smaller but still significant 30%(5 out of 15) of the youngsters in the Control group that were offered constant motivational reinforcement.

CONCLUSION

In conclusion, our study has highlighted how the installation of an electronic measuring device placed inside intraoral protective appliances (M.G.) does not negatively influence the motivation to wear these devices; indeed, the athletes all proved willing to use them regularly in both TRAINING AND COMPETITION.

This finding bodes well for the use of these control appliances and we believe that particularly in the case of young children who practice sports, it is a method that can replace or provide a valid alternative to the established motivational reinforcement methods that may at times be unreliable.

The innovative method of placing the chip inside the M.G., together with the possibility of increasing miniaturization and decreasing costs in the future means that these intraoral protective devices will become more widespread especially among adolescents whose use of mouth guards should be strongly encouraged when they engage in sports in which traumas are a risk factor. Further studies with larger numbers of participants will be necessary, and are already in the planning stage, in order to corroborate the interesting findings and data obtained from the present study.

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