OPEN ACCESS Freely available online

ISSN: 2161-1122
Dentistry

Research Article

Sports Mouthguards and the Ideal Thickness for High Formance Mix Martial Arts MMA Athletes

Nathalie Evangelia*

Department of Sports, FAPESP Research Sao Paulo Research Foundation, Sao Paulo, Brazil

ABSTRACT

Custom made mouthguards can be made in different thicknesses. The aim of this study was to analyze the performance of mouthguards in thicknesses of 4 mm, 5 mm and 6 mm in contact sport athletes in 7 weight categories. All athletes train and compete in the mix martial arts, MMA sport. The weight categories follow the classification of the Association of Boxing Commissions (ABC), 2009, which is also used by MMA. It is a fact that the strength of a 60 kg athlete is not the same as that of a 120 kg athlete. Consequently, the thickness of the mouthguards of these athletes can be different, further assisting the athlete's performance. This research tests the premise that thicker mouthguards serve all types of athletes and covers various categories of weight and thickness of mouthguards. As a result of this study, it appears that there is a relationship between the athlete's weight and the thickness of the mouthguard and that by taking advantage of this relationship, the athlete's performance improves. Research shows that the heavier the athlete, the greater the preference for a thicker mouth guard. And the lighter the athlete is, the greater the preference for a less thick mouthguard. It is concluded that the premise, of greater thickness for any athlete is not confirmed and that the athlete's weight is a relevant component in choosing the thickness of the protector.

Keywords: Mouthguards; Sports dentistry; MMA; Thickness; High performance athlete

INTRODUCTION

The mouthguard is a rubber device used inside the oral cavity and adapted to the teeth. The first mouthguard was developed in 1921 by Phillip Krause, an English dentist son of a boxer. This mouth guard was made with Gutta-Percha, a material similar to that used in the manufacture of gum. After a century, modifications were made to mouthguards, such as raw materials, equipment and even sports. Currently, mouthguards are used in boxing (fights), in addition to other sports, whether contact sports or not [1].

Working exclusively with the manufacture of mouthguards since 2005, it is observed that many athletes who fight MMA, professional or not, usually ask the dentist for a mouthguard with maximum possible thickness. In general, many dentists respond to their patients' requests, showing that greater thickness provides greater protection. However, this occurs due to a lack of information or scientific background that will make it possible to better guide their patients or seek the best protection and performance ratio. Some types of fights for high performance athletes who use mouthguards have the so-called "weighing" of the athlete. Each weight represents a category in MMA (which may vary from one event to the next).

Combat and fighting sports at a competitive level are generally categorized by weight limits of fighters. This happens in order to seek a balance between fighters taking into account that fighters with the same body mass would have equal objective conditions during the fight, reducing differences in strength and speed between the fighters [2].

The Association of Boxing Commissions (ABC) created on July 30, 2009 a table of the main categories and weight of the male fighters (Table 1). The information in this table is so important

Correspondence to: Nathalie Evangelia, Department of Sports, FAPESP Research Sao Paulo Research Foundation, Sao Paulo, Brazil; E-mail: nathalie@forcefield.com.br

Received: 04-Aug-2020, Manuscript No. DCR-24-5889; **Editor assigned:** 07-Aug-2020, PreQC No. DCR-24-5889 (PQ); **Reviewed:** 21-Aug-2020, QC No. DCR-24-5889; **Revised:** 01-Aug-2024, Manuscript No. DCR-24-5889 (R); **Published:** 29-Aug-2024, DOI: 10.35248/2161-1122.23.14.698

Citation: Evangelia N (2024) Sports Mouthguards and the Ideal Thickness for High Formance Mix Martial Arts MMA Athletes. J Dentistry. 14:698.

Copyright: © 2024 Evangelia N. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

that an athlete can refuse to fight if his opponent has a strength advantage.

Thus, it was decided to make mouthguards and dimension the thickness according to their category and the athlete's weight.

Table 1: Some of the main categories and weights of male fighters.

Category	Name in English	Weight (Kg)	Weight (lbs)
Weight fly	Fly weight	56.7	125
Weight cock	Bantam weight	61.2	135
Weight pen	Feather weight	65.7	145
Light weight	Light weight	70.3	155
Medium weight mid	Welter weight	77.1	170
Middle weight	Middle weight	83.9	185
Light heavy weight	Light heavy weight	92.9	205
Heavy weight	Heavy weight	120.2	265

It is known that the strength of a 60 kg athlete is not the same as that of a 120 kg athlete. Consequently, the thickness of the mouthguards can be different, further assisting the athlete's performance. Thus, the aim of this study was to evaluate the effect of the thickness of the mouthguards for the sport sport Mix Martial Arts (MMA) in the different weight categories [3].

MATERIALS AND METHODS

In this study, 35 professional MMA athletes aged 20 to 34 years were evaluated, 25 from the Chute Boxe Diego Lima team and 10 athletes from academia 011, both teams from the city of Sao Paulo. None of the athletes had any type of prosthesis, fractures of anterior teeth, implants or endodontic problems. The athletes had weights ranging from 52 kg to 120 kg. All athletes train professionally in MMA and do sparring 3 times a week, with training time of 1:30 hs per day. The daily physical preparation and training mentioned above was not taken into account in this research [4].

Initially, the molding of the upper and lower arch of all athletes was performed with alginate in a metal tray used for orthodontics. Then, the alginate mold was cast with special type IV dental plaster. Alginate and special type IV plaster were handled according to the manufacturers' recommendations.

After plaster setting, the mouthguards were made by forcefield with Ethil Vinyl Acetate (EVA) plates in thicknesses of 1 mm, 2 mm and 3 mm. EVA plates were joined to obtain samples of mouthguards with final thickness of 4 mm, 5 mm and 6 mm [5]. Then, the EVA sheets in these thicknesses were taken to a vacuum machine with a power of 1,400 Watts. The mouthguards were finished with max cut tips and polishing rubber on a bench motor. A total of three laminated mouthguards were made for each athlete in thicknesses of 4 mm, 5 mm and 6 mm (Table 2).

Table 2: List of athletes by category who participated in the study with the athlete's Kgf calculation.

Category	Protector thickness	Weight (kg)	Gender	Kgf
Straw	4, 5 and 6 mm	52 kg	5 male	530,645 Kgf
Fly	4, 5 and 6 mm	57 kg	5 male	581,669 Kgf
Cock	4, 5 and 6 mm	60 kg	5 male	612,283 Kgf
Feather	4, 5 and 6 mm	66 kg	5 male	673,511 Kgf
Light	4, 5 and 6 mm	70 kg	5 male	714,330 Kgf
Medium heavy	4, 5 and 6 mm	92 kg	5 men	938,834 Kgf
Heavy weight	4, 5 and 6 mm	120 kg	5 male	1,224,566 Kgf

To simulate the articulation, the plaster models were fixed on a semi-adjustable articulator with common plaster and a hot air gun was used to assist in adjusting mouthguards for articulation [6].

Each mouthguard was used during a week of fighting training giving a total of 4:30 hs of use per mouthguard. As each MMA fight has 3 rounds of 5 minutes each, this time of daily use is equivalent to the time of using the mouthguard in 18 normal MMA fights [7]. To obtain the kgf results for each athlete, the following formula was used.

$F=(M \times V \times V)/(254 \times D)$

V=Speed 36 km/h with the average speed of a stroke=10 m/s

M=Mass (athlete's weight in Kg)

D=Distance of 0.5 mm

Elapsed, one week after using the mouthguard, each athlete responded a questionnaire (Table 3). Each athlete answered the questionnaire 3 times, once a week of testing, for each thickness of mouthguard used that week. The athletes responded independently, without being aware of the others [8].

Table 3: Questionnaire.

Speech-how was it to communicate	Great	Good	Bad
Volume-thickness of material in the mouth	Great	Good	Bad
Breathing-during combat	Great	Good	Bad
Absorption of blows and impacts in the mouth	Great	Good	Bad
Comfort in using	Great	Good	Bad

At the end of the third week, an interview was conducted with each athlete to understand the reasons and to define which thickness they preferred to use. What led to this choice: Comfort in use; feeling of protection, how you feel the impact of your opponent's blows; as well as, their perception of absorption; ease of breathing and/or excess salivation and ease of communication. The results of the responses received are compiled and in case of disagreement between the opinions of the athletes, the most common response in each category is presented [9].

RESULTS

Table 4 shows the results of the 4 mm thick mouthguard. It is observed that there was a better acceptance of the mouthguard with a thickness of 4 mm, in terms of speech, volume, breathing absorption and comfort for athletes with weight ranging from 52 kg to 92 kg. 100% approval was for athletes weighing 66 kg and 70 kg. Table 5 shows that for the 5 mm mouthguard, there was a better acceptance for athletes weighing between 60 kg and 120 kg. 100% approval was only for athletes with 92 kg [10]. Table 6, on the other hand, shows the results of the mouthguard with a thickness of 6 mm. In this thickness, the best acceptance was for athletes weighing 92 kg and 120 kg, with 100% acceptance for athletes weighing 120 kg.

Table 4: Mouthguard with a thickness of 4 mm.

Category weight	52 kg	57 kg	60 kg	66 kg	70 kg	92 kg	120 kg
Speaks	Great	Great	Great	Great	Great	Great	Great
Volume	Good	Good	Good	Great	Great	Great	Great
Breath	Great	Great	Great	Great	Great	Great	Great
Absorption	Great	Great	Great	Great	Great	Good	Bad
Comfort	Good	Great	Great	Great	Great	Great	Great

Table 5: Mouthguard with a thickness of 5 mm.

Category weight	52 kg	57 kg	60 kg	66 kg	70 kg	92 kg	120 kg

Talk	Good	Good	Good	Good	Good	Great	Great
Volume	Bad	Bad	Good	Good	Good	Great	Great
Breath	Good	Good	Good	Good	Good	Great	Great
Absorption	Great	Great	Great	Great	Great	Great	Good
Comfort	Bad	Good	Good	Good	Good	Great	Great

Table 6: Mouthguard with a thickness of 6 mm.

Weight category	**52 kg**	**57 kg**	**60 kg**	**66 kg**	**70 kg**	**92 kg**	**120 kg**
Talk	Bad	Bad	Bad	Bad	Good	Great	Great
Volume	Bad	Bad	Bad	Bad	Bad	Great	Great
Breath	Bad	Bad	Good	Good	Good	Great	Great
Absorption	Great	Great	Great	Great	Great	Great	Great
Comfort	Bad	Bad	Bad	Bad	Good	Good	Great

DISCUSSION

The results of Tables 4-6 are analyzed and it is verified that there is an adequate relationship between the athlete's weight and the thickness of the mouthguard. The heavier the athlete, the greater the preference for a thicker mouth guard. And the lighter the athlete is, the greater the preference for a less thick mouth guard [11].

It is observed that the tested 4 mm mouthguard had a better acceptance among athletes weighing 52 kg to 70 kg. And it had 100% approval among athletes from 66 kg to 70 kg.

Athlete with less weight and consequently, less body mass, has a smaller internal space in the mouth and therefore, discomfort with the volume of material in the case of thicker protectors. This was the case with the 5 mm mouthguard used by 52 kg and 57 kg athletes and the 6 mm mouthguard used by 52 kg, 57 kg, 60 kg, 66 kg and 70 kg athletes. On the other hand, the 4 mm mouthguard, despite being very comfortable, was not well accepted by the 120 kg athletes, as it turns out that they felt their opponent's blows more. In other words, the thickness of 4 mm was not enough to absorb the impacts of blows during fights, in this weight category [12].

CONCLUSION

Conclude with this study that a custom made mouthguard with the appropriate thickness in relation to the athlete's weight and his sport MMA brings benefits in performance and protection.

Also noticed that a 6 mm mouthguard when used by a 57 kg MMA athlete is not the most suitable because of the unnecessary volume of material in relation to the athlete's strength of that weight. Consequently, excess thickness impairs breathing and performance.

And I could conclude that a 4 mm mouthguard when used by a 120 kg MMA athlete is also not the most suitable. Even though this mouthguard offered the maximum comfort for being thinner, but it was insufficient in relation to the impact absorption for an athlete with 1,224,566 kgf.

FINAL CONSIDERATIONS

This research tests the premise that thicker protectors serve all types of athletes and covers various categories of weight and thickness of protectors. It is concluded that the premise above, of greater thickness for any athlete is not confirmed and that the athlete's weight is a relevant component in choosing the thickness of the protector.

This study demonstrates that the definition of the most suitable thickness of a mouth guard involves not only the athlete's sport, but also a much larger set of variables. In this investigation, a variable, Kgf, is used in relation to the thickness of the protector for MMA athletes and a relationship is reached (kgf/thickness/MMA). You can have other variables in order to improve the athlete's performance and to suit your real needs.

It is also observed that the “thicker” mouthguard is not necessarily the best mouthguard for all categories of athlete. It is necessary to measure that the athletes are not all the same and consequently the mouthguards should also not be. That is why it is recommended to use customized and tailor-made mouthguard, which allows this diversity in thickness, providing better comfort for the athlete without losing in impact absorption quality and optimizing high performance

REFERENCES

1. Knapik JJ, Marshall SW, Lee RB, Darakjy SS, Jones SB, Mitchener TA, et al. Mouthguards in sport activities: History, physical properties and injury prevention effectiveness. Sports Med. 2007;37(2):117-144.
2. Artioli GG, Franchini E, Junior AH. Weight loss in grappling combat sports: Review and applied recommendations. Braz J Kinathrop Hum. 2006;8(2):92-101.
3. Reale R, Slater G, Burke LM. Individualised dietary strategies for olympic combat sports: Acute weight loss, recovery and competition nutrition. Eur J Sport Sci. 2017;17(6):727-740.
4. Manka-Malara K, Trzaskowski M, Mierzwinska-Nastalska E. Dimensions of hybrid and nanohybrid mouthguards for mixed martial arts fighters-evaluation of a new method of fabrication. Polymers. 2022;14(24):5369.
5. Manka-Malara K, Trzaskowski M, Kovalenko K. Influence of "boil and bite" mouthguards used by mixed martial arts athletes on the stomatognathic system. J Prosthet Dent. 2022;72(4):305-311.
6. Styriak R, Hadza R, Arriaza R, Augustovicov D, Zemkova E. Effectiveness of protective measures and rules in reducing the incidence of injuries in combat sports: A scoping review. J Funct Morphol Kinesiol. 2023;8(4):150.
7. Hamdan JL, Rath M, Sayoc J, Park JY. A brief descriptive outline of the rules of mixed martial arts and concussion in mixed martial arts. J Exerc Rehabil. 2022;18(3):142-154.
8. Jones AJ, Hasnain F, Shipchandler TZ, Vernon DJ, Elghouche AN. Characteristics of facial trauma in professional mixed martial arts. Facial Plast Surg Aesthet Med. 2023;25(4):332-337.
9. Plush MG, Guppy SN, Nosaka K, Barley OR. Exploring the physical and physiological characteristics relevant to mixed martial arts. Strength Cond J. 2022;44(2):52-60.
10. Kataoka SH, Setzer FC, Gondim Jr E, Caldeira CL. Impact absorption and force dissipation of protective mouth guards with or without titanium reinforcement. J Am Dent Assoc. 2014;145(9): 956-959.
11. Bueno JC, Faro H, Lenetsky S, Goncalves AF, Dias SB, Ribeiro AL, et al. Exploratory systematic review of mixed martial arts: An overview of performance of importance factors with over 20,000 athletes. Sports. 2022;10(6):80.
12. Beckman EM, James LP, Kelly VG. Review of the literature high performance testing for the elite mixed martial artist. J Strength Cond Res. 2014;22(6).