

Original Article / Orijinal Araştırma

Evaluation of intraocular pressure changes in elite boxers after a boxing bout

Boks müsabakasından sonra elit boksörlerin göz içi basınç değişikliklerinin değerlendirilmesi

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Abstract

Aim. The aim of this study was to investigate the changes that take place in intraocular pressure in elite boxers after a boxing bout. **Methods.** The study included 18 elite boxers. Participants were required to attend to fifteen minutes warming up and 4 round boxing bout. The baseline intraocular pressures of all athletes before exercise was measured and the measurements were repeated immediately after the boxing bout and 1 and 6 hour later. **Results.** The mean intraocular pressures of the right and left eyes before exercise were 14.61±3.25 mmHg and 14.88±3.16 mmHg and immediately after exercise were 10.94±3.33 mmHg and 11.11±3.04 mmHg respectively. Significant differences were found when the before and immediately after exercise intraocular pressures were compared (p <0.05). IOP returned to baseline in an hour and didn't show any significant change later. **Conclusion.** An intraocular pressure decrease was determined immediately after boxing bout but the quantity of this decrease was smaller than we expected.

Keywords: Intraocular pressure, boxing, exercise

Özet

Amaç. Bu çalışmanın amacı boks karşılaşmasından sonra elit boksörlerde göz içi basınç değişikliğinin değerlendirilmesidir. **Yöntem.** On sekiz elit boksör çalışmaya dahil edilmiştir. Katılımcıların 4 round boks müsabakası öncesi 15 dakika ısınma egzersizleri yapması istenmiştir. Egzersiz öncesi ilk göz içi basıncı ölçümü yapılmış ve tekrarlayan ölçümler ise boks müsabakasından hemen sonra, birinci ve altıncı saatlerde gerçekleştirilmiştir. **Bulgular.** Egzersiz öncesi sağ ve sol gözün ortalama göz içi basınç değeri 14.61±3.25 mmHg ve 14.88±3.16

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mmHg olarak bulunurken, egzersizden hemen sonra bu değer 10.94 ± 3.33 mmHg ve 11.11 ± 3.04 mmHg olarak belirlenmiştir. Egzersiz öncesi ve sonrası göz içi basınç değerleri karşılaştırıldığı zaman istatistiksel olarak anlamlı fark bulunmuştur ($p < 0.05$). Bir saat sonraki ölçümde göz içi basıncının normal değere döndüğü ve sonrasında değişmediği görülmüştür. **Sonuç.** Boks müsabakası sonrası derhal yapılan ölçümlerde göz içi basıncında düşüş olduğu görülmüş, fakat bu düşüşün beklenenden az olduğu tespit edilmiştir.

Anahtar sözcükler: Göz içi basınç, boks, egzersiz

Introduction

In recent years, several studies have shown that exercise reduces intraocular pressure (IOP) and it has been reported that the amount of IOP reduction after exercise depend on the intensity of exercise, not on the duration or the quantity of exercise [1-6]. This pattern has been demonstrated in healthy adults, elderly subjects, sedentary subjects, trained athletes, and in those with elevated IOP or glaucoma [3, 4, 7-9]. A greater reduction in IOP occurs in subjects with a higher IOP, and in sedentary subjects compared with trained or fit [2, 6, 7, 10].

Elevated plasma osmolarity has been advocated as the underlying mechanism of IOP reduction during exercise. It has been proposed that the rise in plasma osmolarity creates an osmotic disequilibrium between aqueous humor and plasma, favoring the movement of water from the aqueous humor to the blood. This reduces the rate of aqueous humor formation and lowers IOP [7, 11, 12].

Different types of exercise have different effects on IOP. Qureshi [3] showed that IOP decreases 2.43 mm Hg after walking, 3.85 mm Hg after jogging, and 4.0 mm Hg after running. During acute dynamic exertion IOP falls and after cessation of exercise IOP returns to baseline within an hour [13].

Boxing is one of the most intense cardiovascular activities for any athlete and differs from other sports with high incidence of blunt ocular traumas. Due to these reasons we thought that IOP might change in a different manner at boxing sport. In this study, we aimed to investigate IOP changes in elite level boxers after a boxing bout. To our knowledge, no previous study has evaluated IOP changes at boxing sport.

Material and Methods

This study was conducted with 18 male athletes (age 19.8 ± 2.2 ; weight 64.1 ± 12.3 kg; height 172.2 ± 6.8 cm) who are elite level boxers (duration of sporting 7.4 ± 1.8 years). Written informed consent was obtained from all participants, and the local ethics committee approved the study.

Participants were required to attend to fifteen minutes warming before 4 round bout. Each round was 2 min. IOP was measured with pneumotometry by an ophthalmologist without using an anesthetic. Ten min of seated rest preceded baseline measurements of intraocular pressure. The IOP measurements of both eyes were done again immediately and 1 and 6 h after the boxing bout.

Statistics were analyzed by using the Friedman and Wilcoxon tests. A p value of <0.05 was considered significant.

Results

The mean IOPs of the right and left eyes before exercise were 14.6 ± 3.2 mmHg and 14.9 ± 3.2 mmHg, respectively. The mean IOPs of the right and left eyes immediately after exercise were 10.9 ± 3.3 mmHg and 11.1 ± 3.0 mmHg respectively. The differences in mean IOPs between, before and immediately after exercise for the right and left eyes were statistically significant. (right eye $X^2=30.9$, $P=0.001$; left eye $X^2=34.9$, $P=0.001$). IOP returned to baseline in an hour and didn't show any change.

As a consequence, boxing exercise has been found to reduce IOP and we found a mean reduction of 3.7 mmHg in right eye and 3.8 mmHg in left eye.

Discussion

In this study, we determined an IOP decrease immediately after boxing exercise but the quantity of this decrease was not as we expected. We expected more decrease at IOP due to intensity of this exercise. In a previous study it has been shown that exercise intensity determines the magnitude of IOP decrease [1].

The magnitude of the IOP drop is thought to be related to the relative workload on a given subject rather than the absolute workload [1, 2, 7, 14]. The relative workload describes the exertion required relative to their level of fitness. It is also widely accepted that physical fitness due to an exercise regimen results in lower baseline IOP; although, in fit individuals the acute IOP-lowering effect of exercise may be diminished [6,10]. The participants of this study are elite level boxers and relative workload on these athletes are not too much. We can explain the diminished IOP decrease in this way.

High-speed photography has revealed that impacting objects larger than the orbital entrance opening like boxing glove, undergo significant deformation on impact, allowing a small protuberance to enter the orbital cavity and impacting the eye globe [15]. The damage from the impact of a blunt object causes rapid compression of the ocular tissue resulting in rapid elongation along the equatorial plane. In applanation tonometry the intraocular pressure is inferred from the force required to flatten (applanate) a constant area of the cornea and repeated applanation measurements have been shown to decrease IOP. This decrease was explained with forced drainage of anterior chamber fluid due to indentation of the tonometer [16, 17]. We thought that anterior chamber fluid may also be forced to drainage by blunt trauma created by boxing glove and this action may also cause IOP decrease.

Most frequently, the anterior segment is the primary structure involved in an ocular contusion. Trauma to the highly vascularized iris and the angle structures may lead to bleeding inside the anterior chamber. The most common consequence of any hyphema is acute elevation of the IOP, which is directly related to the amount of blood in the anterior chamber. Red blood cells, fibrin, and cellular debris seem to be responsible for the obstruction of the trabecular meshwork that leads to acute ocular hypertension [18]. In this study we didn't observe IOP increase or hyphema in any athlete.

Harris et al. [6] suggested that dehydration causing an increase in plasma osmolarity could also lower the rate of aqueous formation and reduce the IOP. It has been also found that intraocular pressure was progressively reduced during a period of exercise causing dehydration, but remained relatively stable when hydration was maintained [19]. In this study the participants didn't drink water during the exercise period. This may also has an effect on IOP decrease due to dehydration during exercise. IOP levels return to baseline after 1 hour and rehydration of boxers after exercise may also affect this return.

IOP was reduced immediately after a boxing bout and returned to baseline level after one hour. The IOP decrease was diminished due to fitness level of athletes. Further research is necessary for to understand whether a blunt trauma has a role on IOP decrease after a boxing bout.

Conflicts of interest

The authors stated no conflicts of interest.

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