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Title: Intraocular pressure as an indicator of the level of induced-anxiety in basketball

Running head: Free throw anxiety modulates intraocular pressure

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Abstract

Statement of significance: Our data demonstrates that intraocular pressure is sensitive to anxiety manipulation in sport scenarios, specifically in a basketball free throws task. The present outcomes may be of special relevance due to its practical advantages for the objective control of athletes´ anxiety levels.

Purpose: Athletes experience high levels of anxiety during sport competition, and intraocular pressure (IOP) has demonstrated to reflect autonomous nervous system changes during mentally demanding situations. We tested whether different levels of induced-anxiety during basketball free throws shooting alter IOP.

Methods: We followed a repeated measures design to test the effects of induced-anxiety manipulation during basketball free-throw shooting on IOP, shooting performance, and perceived anxiety. Eighteen amateur basketball players performed three experimental sessions consisting of 100 free throws each. However, we gave three different instructions to participants regarding the score assigned to each free throw, allowing us to manipulate the level of induced-anxiety (low, medium and high).

Results: Confirming a successful anxiety manipulation, basketball players reported more perceived anxiety with higher levels of induced-anxiety ($p<0.001$, $\eta^2=0.37$). Our data show that higher levels of induced-anxiety provoke an acute IOP rise ($p<0.001$, $\eta^2=0.44$), with the low, medium, and high induced-anxiety conditions promoting an average IOP rise of 0.21%, 1.63% and 18.46%, respectively. Also, there was a linear IOP rise over time in the high induced-anxiety condition ($r=0.82$). Nevertheless, we found no effect of induced-anxiety manipulation on basketball free-throws performance ($p=0.926$).

Conclusions: IOP is sensitive to anxiety-induced manipulation during basketball free-throws shooting, showing an increase in parallel with accumulated anxiety. Based on these finding, IOP may be considered as a promising tool for the assessment of the level of anxiety in certain sport situations. Future studies are required to explore the generalizability of these results in others scenarios with different physical and mental demands.

Keywords: ocular physiology, stress reactivity, training load management.

Intraocular pressure as an indicator of the level of induced-anxiety in basketball

Introduction

Anxiety is characterised by a psychological, physiological, and behavioural response to anticipation of an aversive event, and by itself can also amplify the psychological and physiological reaction to that event.[1] For sport psychologists, the impact of anxiety on performance continues to be one of the main research interests, and especially in basketball.[2]

Basketball games are characterised by crucial and non-crucial game situations, and players need to adjust their decision behaviours depending on the game situations [3]. High-criticality situations (i.e., end phase of a close game) have demonstrated to increase the level of anxiety in sport contexts,[4,5] and stressful and anxiety-provoking circumstances may lead to deficits in athletic performance.[6] Based on the inverted-U hypothesis,[7] the level of anxiety influences performance in an inverted-U fashion, with high levels of anxiety leading to a rapid decrease in performance.[8] Nevertheless, experienced players seem to possess regulatory mechanisms (e.g., self-control), which permit them to maintain an appropriate level of performance in high-anxiety situations.[9] In particular, anxiety level manipulation during basketball free-throw tasks seems to reduce performance [5] and impairs attentional control.[2] However, there is accumulated evidence about the complex relationship between arousal and performance, being influenced by numerous factors such as task type, individual characteristics, athlete's global perception of confidence (self-confidence) or task duration.[6,10,11] Despite the fact that the anxiety-sport performance relationship is a complex matter and the shape of this association is not fully understood, there is scientific evidence supporting a negative relationship between excessive anxiety levels and sport performance.[12]

Regarding physiological alterations, several objectives indices (e.g., salivary steroids, heart rate variability) have been used to assess changes from the autonomous nervous system as consequence of cognitive anxiety in elite athletes.[4,13] In the last years, the ocular physiology has demonstrated to be an objective reliable index to capture autonomous nervous system alterations as consequence of physical and mental efforts.[14–17] In this context, intraocular pressure (IOP; i.e., the pressure exerted by the intraocular fluids against the outer coats of the eye[18]) has emerged as a promising objective index to reflect mental efforts in laboratory[19] and applied [20] settings, being also sensitive to different cognitive and affective factors.[21] Basketball players are exposed to different levels of anxiety depending on multiple factors such as moment of the game, importance of the game, referee decisions or current result among many others, which have a direct impact on their performance.[22] Based on the fact that IOP is not under voluntary control, and it has been proved sensitive to the mental complexity,[19,20] we consider of interest to explore the possible use of IOP as an indicator of the level of anxiety experienced in sport, specifically in basketball free-throws. In practical terms, the assessment of IOP by rebound tonometry is an objective, rapid, easy to measure, and well-tolerated technique,[23] being these characteristics specially relevant in ecological contexts. Thus, its sensitivity to the different factors occurring in basketball training (e.g., physical and psychological demands) would permit coaches to quantify and adjust training loads.[24] It is of special relevance since training load depends on exercise characteristics such as exercise volume (duration and frequency) and intensity (pace and power), as well as psychological factors. In this regard, coaches adjust all these variables (e.g., intensity, psychological stress, etc.) during the training cycle to either increase or decrease fatigue depending on the phase of training (i.e. baseline or competition phase), aiming to enhance athletes 'performance.[25]

As stated above, the effects of anxiety depends on task complexity and duration, as well as individual characteristics.[6,10,11] Therefore, the present study was designed to examine the possible cumulative effect of three basketball free-throws conditions with identical physical demands but different levels of induced-anxiety on IOP in an experimental sample of amateur basketball players with a comparable level of expertise. The results from the present study could emphasize the feasibility and benefits of incorporating optometric procedures (i.e., IOP assessment) in applied contexts in which performance or decision making could be altered by the anxiety or mental overload experienced during the task. We hypothesized that higher values of IOP would be obtained with higher levels of induced-anxiety, and also, higher levels of induced-anxiety would be associated with higher levels of perceived anxiety and lower performance.

Methods

Participants

To the best of our knowledge, this study is the first of its nature. Therefore, there are not applicable data to calculate sample size a priori. To exceed the general convention of 80% power at the 5% level needed to conclude that a difference is statistically significant for the main analyzed variable (i.e., IOP) between the three experimental conditions, and assuming an effect size between 0.25 and 0.30, a minimum sample size of 15 to 21 participants was projected. As a result, 22 male amateur basketball players (regional league) were recruited to participate in this study. For eligibility criteria, we considered: 1) at least five years of playing in competitive national Spanish basketball leagues in order to reduce expertise differences among players, 2) baseline IOP below to 21 mmHg, which has been considered as the cut-off value for the inclusion of participants without ocular hypertension in previous studies,[26] 3) be free of any systemic or ocular disease, as checked by slit lamp and direct ophthalmoscopy examination, or under pharmacological treatment, and 4) had no history of ophthalmic surgery or orthokeratology. Participants were asked to refrain from alcohol or caffeine consumption, as well as strenuous physical activity on the days of testing. Four out of twenty-two participants did not complete the entire experiment, and therefore, they were excluded for further analysis. Finally, eighteen male amateur basketball players comprised the experimental sample (mean age ± standard deviation [SD]: 21.28 ± 3.20; years at competitive levels [mean ± SD]: 10.44 ± 3.03).

This study was carried out in accordance with the Declaration of Helsinki, and it was approved by the university Institutional Review Board (approval number: 112/CEIH/2016). Inform consent was obtained from all participants included in the study.

Experimental design and induced-anxiety manipulation

A repeated measures design was used to evaluate the acute impact of induced-anxiety manipulation during basketball free throws on IOP. To do it, participants performed free throws in three conditions, conducted in separate days and counterbalance order. Each experimental condition lasted 60 minutes approximately, and consisted in 100 free throws (performed in series of 2 throws), with the basketball hoop situated at standardised distance (4.60 m) and height (3.05 m). The only difference between conditions, in order to manipulate the level of induced-anxiety, was the scoring system. Free throws were classified as hit or miss. In the low-anxiety condition, each hit and miss shots computed as one and zero points, respectively. In the medium-anxiety condition, each hit added one point but each miss subtracted one point. In the high-anxiety condition, again each hit added one point and each miss subtracted one point, but in addition, to miss the free throw number 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 subtracted five points from the total score, and also, two consecutives misses returned the total score to zero. The explanation of these different scoring systems was given to participants in the familiarization session. At the beginning of each of the three experimental session, we first obtained the baseline IOP measure, and subsequently, participants were informed about the experimental condition to carry out each day in order to avoid the possible influence of anxiety in the baseline IOP measure. We ensured that participants understood the scoring systems by asking them to tell us the scoring rules, and if needed, they were explained again. All experimental sessions were conducted at the same time of the day (19.00 hours) in order to avoid the possible influence of circadian variations on physical performance and IOP, and separated by one week. Also, all sessions were conducted in the same indoor basketball court, using the same basketball hoop, and two experimenters were present during the course of the experiment. One experimenter controlled the scoring system and informed participants about the current score after each free throw and the other experimenter performed the IOP measurements. Aiming to ensure that participants did not lose interest or motivation when they were penalized as a result of some errors in the medium or high-anxiety conditions, two different scoring systems were used (total score and percentage accuracy). Participants, or participant if the winner was the same player in both categories, with the best total score and percentage accuracy received a compensation of 100€ for each of the two scoring systems at the end of the experiment.

Instruments and measurements

Intraocular pressure assessment

We used a clinically validated rebound tonometer (Icare TA01; Tiolat Oy, INC. Helsinki, Finland) to measure IOP.[27] We obtained six IOP measurements in each experimental condition (before the beginning of the experimental session [baseline IOP measurement], and after the free throw number 20, 40, 60, 80 and 100). Participants remained at the free throw line, and IOP was measured in standing position. IOP was measured from a random eye, which was consistently chosen through sessions. Following the manufacturer recommendations, participants were instructed to fixate at a target distance and six rapid consecutive measurements were taken against the central cornea. This apparatus displays whether differences between the measurements, calculated as the mean value from the four central measurements (the lowest and highest are eliminated), are appropriate or there is a large variability between them. We always obtained values with low standard deviation (ideal measure). The illumination conditions were kept constant across experimental sessions (211 ± 14 lx, as measured in the corneal plane [Illuminance meter T-10, Konica Minolta, Inc., Japan]).

Subjective scale

We used the Spanish Version of the State-Trait Anxiety Inventory (STAI) scale to check the level of induced-anxiety after each experimental session.[28] In particular, we only used the state anxiety subscale, which was completed by participants after each experimental condition. This scale is formed by 20 items, and it permits to evaluate the perceived level of state anxiety at a particular moment.[29] This scale has an alpha coefficient of 0.92.[30]

Statistical analysis

A two-way factorial ANOVA, considering the level of induced-anxiety (low, medium and high) and the point of measure (baseline, 20, 40, 60, 80 and 100) as the within-participants factors, and IOP as the dependent variable, was conducted. Also, to ensure that baseline IOP levels were similar between-sessions, we performed a one-way ANOVA for the IOP measures obtained at the beginning of each experimental session with the level of induced-anxiety (low, medium and high) as the within-participants factor. In addition, two separate one-way ANOVAs, using the level of induced-anxiety (low, medium and high) as the within-participants factor and the free throws performance and the perceived anxiety as the dependent variables, were implemented as a manipulation checks. Then, we conducted linear regression analyses for the IOP values at the different points of measure, and in each experimental condition in order to evaluate the cumulative effect of anxiety on IOP. Lastly, separate linear regression analyses were conducted between the perceived level of anxiety and IOP difference (after 100 free throws minus baseline measurement) for each experimental condition in order to determinate the relationship between anxiety and IOP. The value to determine statistical significance was set at 0.05. The Holm-Bonferroni correction for multiple comparisons was used when corresponding. Standardized effect size was reported by means of the partial eta-squared (η^2) for Fs and Cohen´s d for pairwise comparisons.

Results

Eighteen young Caucasian men amateur basketball players participated in the current study. Participants' morphometric characteristics included an average weight of 81.06 ± 6.78 kg, height of 185.28 ± 7.00 cm, and body mass index of 23.59 ± 1.07 kg/m^2. Regarding ocular variables, participants showed a mean spherical equivalent of -0.65 ± 0.42 D (range: -1.75 to +1.25 D) and corneal thickness of 538.50 ± 14.75 µm (range: 520 – 556 µm).

Performance and manipulation check

Table 1 shows the descriptive statistics of basketball free-throws performance and perceived level of anxiety in the three conditions. As expected since the scoring system was different, participants obtained a worse total score during the free throws tasks with higher levels of induced-anxiety ($F_{2,34} = 27.44$, $p < 0.001$, $\eta^2 = 0.62$), and these effect were also observed for the analysis of multiple comparisons (low vs. medium: corrected p-value < 0.001, d = 1.21; low vs. high: corrected p-value < 0.001, d = 1.51; and medium vs. high: corrected p-value = 0.002, d = 0.84). The percentage accuracy did not yield statistical significance for the level of induced-anxiety ($F_{2,34} = 0.08$, $p = 0.926$). Regarding the level of perceived anxiety using the STAI (state subscale), participants reported higher perceived anxiety with higher levels of induced-anxiety ($F_{2,32} = 9.40$, $p < 0.001$, $\eta^2 = 0.37$). Post-hoc comparisons revealed statistical differences between the low and high conditions (corrected p-value = 0.007, d = 0.87), and between the medium and high conditions (corrected p-value = 0.015, d = 0.74), whereas the comparison between the low and medium conditions did not reach statistical significance (corrected p-value = 0.218). These results permitted us to confirm that the condition with the high level of induced-anxiety promoted a higher level of perceived anxiety in comparison to the others experimental conditions. However, the non-significant differences between the low and medium conditions suggest that anxiety manipulation may not have been successful at lower levels.

****Table 1 near here****

Cumulative effect of induced-anxiety on IOP

First of all, we checked that there were no inter-day variations in the baseline IOP measurements ($F_{2,34}$ = 0.421, p = 0.660) (Table 2). To assess the inter-day variability within the sample, we also calculated the intraclass correlation coefficient between the three between-days comparisons (visit 1 vs. visit 2 = 0.82; visit 2 vs. visit 3 = 0.90; and visit 1 vs. visit 3 = 0.85).

The two-way factorial ANOVA reached statistical significance for the level of induced-anxiety ($F_{2,34}$ = 13.17, p < 0.001, η^2 = 0.44), the point of measure ($F_{5,85}$ = 3.27, p = 0.009, η^2 = 0.16), and the interaction level of induced-anxiety x point of measure ($F_{10,170}$ = 3.06, p = 0.001, η^2 = 0.15). The post-hoc comparisons for multiple comparisons demonstrated differences between the low and medium (corrected p-value = 0.020, d = 0.56), the low and high (corrected p-value < 0.001, d = 1.59), and the medium and high levels of induced-anxiety (corrected p-value < 0.001, d = 1.14). For its part, there were not differences between the different points of measure (all corrected p-values > 0.05). In addition, we tested the possible cumulative effect of induced-anxiety on IOP by three separate ANOVA for each experimental condition, considering the point of measurement as the within-participants factor. These analysis showed a significance only for the high induced-anxiety condition ($F_{5,85}$ = 6.90, p < 0.001, η^2 = 0.29), and the post-hoc comparison demonstrated that the IOP value after 60, 80, and 100 free throws were statistically significant higher when compared with the baseline IOP value (corrected p-value = 0.003 and d =1.11; corrected p-value 0.008 and d = 0.99, and corrected p-value = 0.003 and d = 1.16, respectively). A linear regression analysis for the high induced-anxiety condition revealed a positive association between the point of measurement and the IOP rise (r = 0.82) (see Figure 1 and Table 2).

****Figure 1 near here****

****Table 2 near here****

Separate linear regression analyses between the level of perceived anxiety and IOP change for each experimental condition showed a positive association between both variables in the high induced-anxiety condition ($R^2 = 0.50$, $p < 0.01$), whereas this association did not reach statistical significance for the low ($R^2 = 0.12$, $p = 0.167$) and medium ($R^2 = 0.12$, $p = 0.177$) induced-anxiety conditions (Figure 2).

****Figure 2 near here****

Discussion

We examined the effects of the level of induced-anxiety during basketball free-throw shooting on IOP, shooting performance, and perceived anxiety in amateur basketball players. Regarding the manipulation check of the level of anxiety, participants reported higher perceived anxiety, as measured by the state subscale of STAI, for the high induced-anxiety condition. However, different levels of anxiety in basketball free throw shooting did not have any significant influence on performance, which may be explained by athletes´ psychological resources (high cognitive function).[8,31] Relevantly, we found for the first time that IOP is sensitive to the level of induced-anxiety during basketball free throws, showing that higher levels of induced-anxiety promoted greater IOP increments. These results are in accordance with previous studies, which demonstrated that mentally demanding tasks modulate IOP.[19,20,32]

In addition, when the three conditions were analysed separately, only the high anxiety-induced condition promoted a significant IOP rise, showing that IOP levels were significantly higher from the 60 free-throw onward, in comparison to baseline level. Our data also revealed a cumulative effect of high levels of induced-anxiety on IOP, as indicated by the positive linear relationship between the IOP increment and the number of basketball free throws, as well as between the perceived level of anxiety and the IOP change obtained in the high induced-anxiety condition.

Recent studies showed an instantaneous IOP response to physical load, being positively associated the IOP increments with the magnitude of resistance imposed.[33,34] Here, the possible effect of physical effort was controlled since all experimental sessions were matched in physical demands (100 basketball free-throws), and only the instructions given to participants were manipulated in order to modify the level of induced-anxiety. Importantly, our experimental manipulation seemed to be successful since participants reported higher perceived anxiety after performing the high-anxiety condition, which indirectly demonstrates differences in the level of induced-anxiety between experimental conditions.[2] Nevertheless, the level of induced-anxiety did not promote a worse performance, as measured by the percentage accuracy. This may be supported by previous studies which have reported that experienced players exhibit a higher executive functioning, including self-control in highly anxious contexts, when compared to recreational players, which permits to maintain the level of performance.[9,31,35] In view of this, it seems reasonable to state that our experimental sample (amateur players with accumulated experience of 10.44 ± 3.03 years at competitive level) had a sufficient self-control strength to avoid the negative impact of anxiety on performance. As discussed by Janelle[8], high-anxiety may lead to similar performance when compared to low-anxiety circumstances, however, athletes will have to work harder in high-anxiety conditions to maintain performance. In periods of high-anxiety, it has been proposed that attentional and cognitive available resources are limited, and may lead to less automatic and more effortful processing.[36] Taken together, these evidences highlight the importance of anxiety control in sport scenarios. We consider that the types of anxiety manipulation used in the present study could be implemented by coaches in collaboration with sport psychologists during training sessions, since they may permit to improve self-control and processing efficiency, and thus, players´ performance in real game situations. Nevertheless, further evidence is needed to determine whether the proposed anxiety manipulation during training sessions may permit to improve performance in real game contexts.

The balance between the sympathetic and parasympathetic branches of the autonomous nervous system regulates IOP by the generation and drainage of aqueous humour (i.e., the main determinant of IOP), respectively.[37,38] Therefore, the execution of tasks, either physical or mental, that produce central nervous system alterations have been proved to promote an acute IOP response.[19,34] In addition, our results demonstrate a cumulative effect of induced-anxiety on IOP, and therefore, a sufficient time under anxious conditions is required to find IOP increments. This finding is in agreement with the study of Vera et al.[19], who found a progressive increment of the IOP response in parallel to the nervous system´s activation state, as measured by heart rate variability, during a mental workload task. Notably, inter-individuals differences on the physiological responsiveness to acute stress, as well as other possible coexisting factors (e.g., physiological arousal, motivation, etc.), should be considered when interpreting the present outcomes.[39] In addition, we found a positive linear association between the level of perceived anxiety and the IOP change in the high induced-anxiety condition ($r = 0.71$), which partially supports the fact that the IOP behaviour is modulated as a function of perceived anxiety in an individual manner.

Psychological factors have showed to alter performance and the physiological responses promoted during sport, thus, researchers have recently focused their attention on this aspect.[40] In high level competition, athletes are exposed to competition-related anxiety among other stressors, which impact their load-adaptation mechanisms.[25] In this sense, researches pursue looking for reliable tools in order to monitor the athletes' training load, which may permit to reduce the incidence of over-training, and the risk of injury or illness.[40] To that effect, IOP has been shown to be associated with physical or mental effort, as well as with psychosocial stress, considered as a trait measure.[41] Based upon this evidence, we argue that IOP may be tested as a possible index to assess athlete´s training load, however, the external validity of these findings need to be tested in others sport contexts (i.e., situations with concomitant physical and mental requirements).

The use of rebound tonometry presents numerous advantages, especially in applied contexts (e.g., on the basketball court in a training session), as it is rapid and easy to obtain, well-tolerated by individuals, does not require the instillation of topical anaesthesia, and the device is hand-held and portable.[23]

Limitations and future research

Here, we show how anxiety-induced manipulation during basketball free-throws induces a cumulative IOP rise, namely when IOP was measured immediately after the corresponding free throw, However, we must acknowledge some limitations. First, our experimental sample is formed by amateur basketball players, and, as indicated by Jacobson and Matthaeus[35], athletes have demonstrated differences in self-control depending on their level of expertise and type of sport. Thus, our results would not be extrapolated to athletes with different level of expertise or from others sport disciplines. Second, only males were included in this study, and the physiological impact of exercise has showed sex differences.[42] Future studies should include women in their experimental sample. Third, the present findings have been obtained under controlled conditions and with discrete levels of induced-anxiety, but not during a real competition situation where physical and mental demands overlap in an unpredictable manner. Thus, our results may be cautiously interpreted in this regard and need future research. Fourth, IOP changes in the present investigation exhibited a certain level of variability between individuals, and it may limit the application of this relationship for a single subject. Lastly, we took IOP values at different points of measure, however, a continuously recording of IOP may incorporate more detailed information about the effect of different physical or mental manipulations on IOP. The novel development of contact lenses sensors for IOP monitoring (SENSIMED Triggerfish, Lausanne, Switzerland, see De Smedt, Mermoud, & Schnyder[43]) could permit a better understanding of the possible use of IOP as an indicator of training load.

Summing up, we found that IOP reflects anxiety-induced manipulation during a basketball free-throw task, with a cumulative and acute IOP rise as consequence of high level of induced-anxiety. IOP, as measured by rebound tonometry, offers a potentially valid index to evaluate athletes´ anxiety levels in field situations, although inter-individuals differences may limit the application of this relationship to a single basketball player. This preliminary evidence needs further investigation to determine whether the present outcomes are specific or generalizable.

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Figure caption

Figure 1. Effects of the level of induced-anxiety at the different points of measurement on intraocular pressure. In the x-axis, baseline represents the average IOP value before any effort, and 20, 40, 60, 80 and 100 indicate the average IOP value after the free throw number 20, 40, 60, 80 and 100, respectively. * and ** indicate statistically significant effect for the level of induced-anxiety at each point of measurement (p-value < 0.05 and < 0.01, respectively). † and § indicate statistical significance of low induced-anxiety vs. high induced-anxiety, and medium induced-anxiety, respectively (corrected p-value < 0.05). Markers and errors bars represent the mean and standard error, respectively. All values are calculated across participants (n = 18).

Figure 2. Linear regression obtained between the changes in intraocular pressure and perceived levels of anxiety in the low (panel A), medium (panel B) and high (panel C) induced-anxiety conditions. The linear equations are shown with the corresponding coefficient of determination (R^2). All values are calculated across the total sample (n = 18).

Table 1. Descriptive values of performance and perceived level of induced-anxiety in each experimental condition.

	Low induced-anxiety (M ± SD)	Medium induced-anxiety (M ± SD)	High induced-anxiety (M ± SD)	p-value
Total score	78.44 ± 12.68	56.33 ± 28.61	32.00 ± 37.43	< 0.001
Percentage accuracy	78.22 ± 12.63	77.56 ± 14.85	77.56 ± 17.12	0.926
STAI (state anxiety)	15.59 ± 6.39	17.00 ± 5.73	21.53 ± 7.59	< 0.001

Note: M = mean; SD = standard deviation.

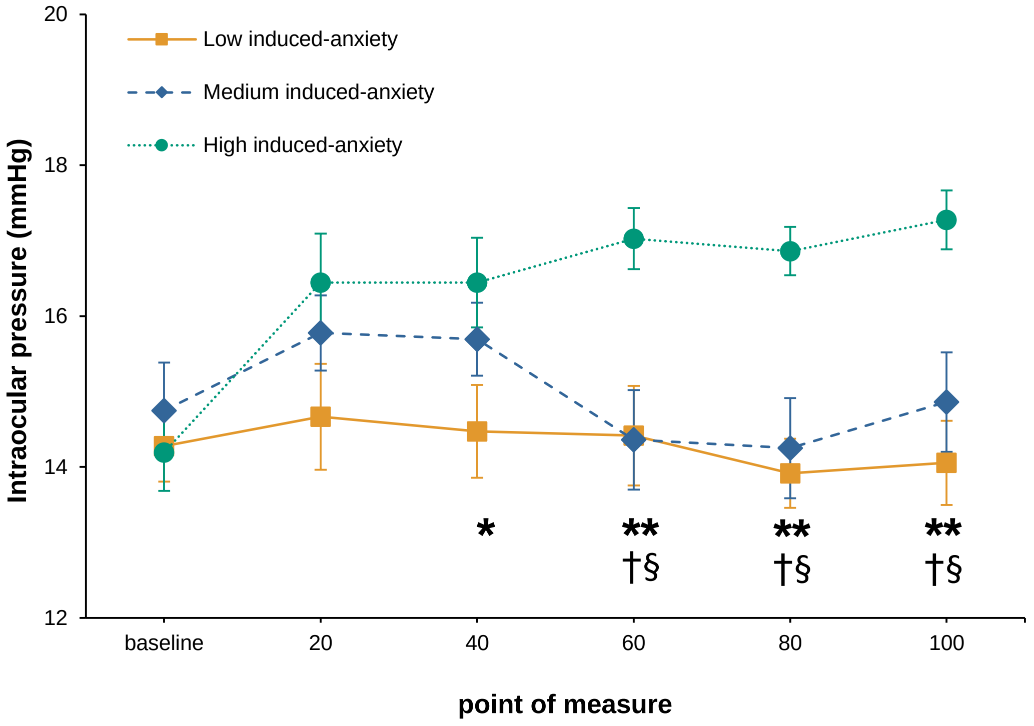
Table 2

Table 2. Descriptive values of intraocular pressure in each experimental condition and point of measurement.

IOP measurement (mmHg)	Low induced-anxiety (M ± SD)	Medium induced-anxiety (M ± SD)	High induced-anxiety (M ± SD)
Baseline	14.28 ± 1.99	14.75 ± 2.69	14.19 ± 2.17
After 20 free-throws	14.67 ± 2.98	15.78 ± 2.12	16.44 ± 2.75
After 40 free-throws	14.47 ± 2.60	15.69 ± 2.05	16.44 ± 2.52
After 60 free-throws	14.42 ± 2.80	14.36 ± 2.80	17.03 ± 1.72
After 80 free-throws	13.92 ± 1.94	14.25 ± 2.81	16.86 ± 1.36
After 100 free-throws	14.06 ± 2.37	14.86 ± 2.80	17.28 ± 1.66

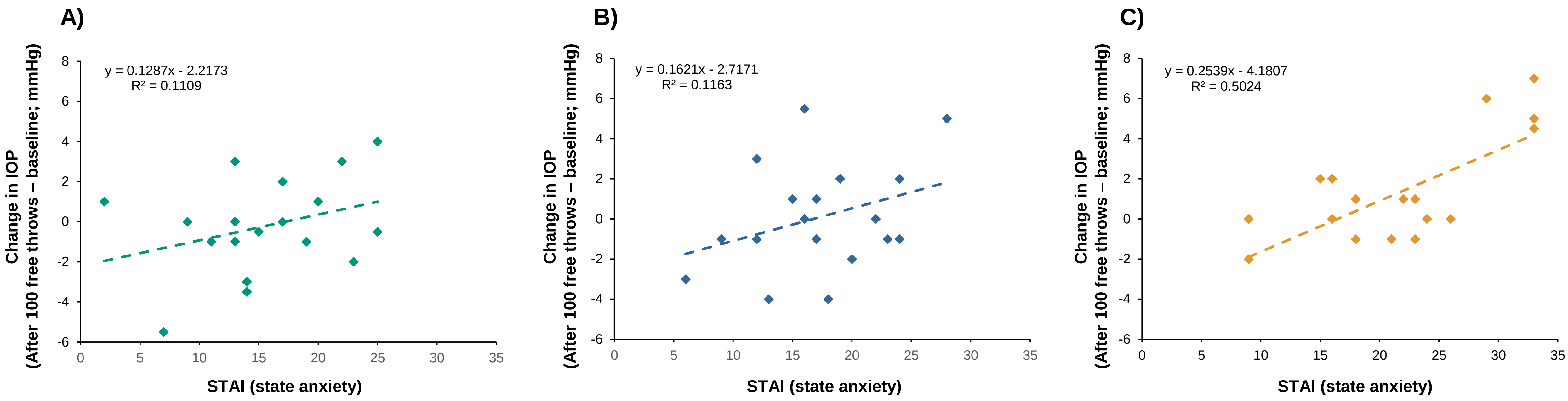
Note: M = mean; SD = standard deviation; IOP = intraocular pressure.

Figure 1



20
18
16
14
12
Intraocular pressure (mmHg)
Low induced-anxiety
Medium induced-anxiety
High induced-anxiety
*
**
†§
**
†§
**
†§
baseline
20
40
60
80
100
point of measure

Figure 2


A)
y = 0.1287x - 2.2173
R² = 0.1109
Change in IOP
(After 100 free throws – baseline; mmHg)
STAI (state anxiety)
8
6
4
2
0
-2
-4
-6
0
5
10
15
20
25
30
35
B)
y = 0.1621x - 2.7171
R² = 0.1163
Change in IOP
(After 100 free throws – baseline; mmHg)
STAI (state anxiety)
C)
y = 0.2539x - 4.1807
R² = 0.5024
Change in IOP
(After 100 free throws – baseline; mmHg)
STAI (state anxiety)