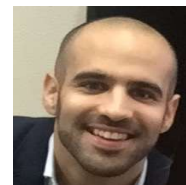


# THE INFLUENCE OF INTRAORAL DEVICES IN SALIVARY CORTISOL LEVELS OF GOLF ATHLETES – A PILOT STUDY



**Pedro Cebola<sup>1</sup>, Vera Chéroux<sup>1</sup>, Luís Xavier Santos<sup>1</sup>, Alexandra Bernardo<sup>1,2</sup>, Carlos Família<sup>1,2</sup>, André Almeida<sup>1,2</sup>, Sérgio Félix<sup>1,2</sup>, José Martins do Santos<sup>1,2</sup>, Catarina Godinho<sup>1,2</sup>**

<sup>1</sup>Instituto Superior de Ciências da Saúde Egas Moniz (ISCSEM), Quinta da Granja, Monte de Caparica, 2829-511 Caparica, Portugal.

<sup>2</sup>Centro de Investigação Interdisciplinar Egas Moniz (CiiEM), Cooperativa de Ensino Superior, C.R.L., Quinta da Granja, Monte de Caparica, 2829-511 Caparica, Portugal.

**INTRODUCTION:** A removable intraoral device is often manufactured in hard acrylic that is placed over the incisal and occlusal surfaces of the teeth (1). The correlation between the intraoral devices and the concentration of cortisol has been reported in previous works where the observed cortisol reduction levels were attributed to a hormonal cascade reaction (2-3). This study aimed to analyze the changes in salivary cortisol levels and the state of anxiety with the use of intraoral devices totally adapted in Golf athletes.

**MATERIALS AND METHODS:** After study approval by the Ethic Commission of the Cooperativa de ensino Egas Moniz, athletes from the Centro Nacional de Formação de Golfe do Jamar (CNFGJ), (Fig. 1), were invited to participate in this study. Following the informed consent, a Diagnostic Criteria for Temporomandibular Disorder (DC/TMD) was applied. In order to ensure anonymize, all data were coded. Individualized intraoral devices (IOD) were developed for each athlete (Fig. 2). Athletes held a 9-hole tournament with two phases: one phase without and another with the use of the IOD (Fig. 3). To analyze the stress levels, salivary cortisol levels were accessed through a chemiluminescent enzyme immunoassay (Immulite 1000), and requested the completion of the Competitive State Anxiety Inventory-II (CSAI-II). Linear mixed effect models were used to evaluate the effect of the use the intraoral device, evaluation moment and interaction between them and the logarithm of salivary cortisol concentration and anxiety levels. Significance of these effects was assessed through the analysis of variance of type III with Kenward-Roger approximation for the number of degrees of freedom.



FIGURE 1 - Centro Nacional de Formação de Golfe do Jamar – Lisboa (CNFGJ).



FIGURE 2 - IOD after obtaining Centric Relation and occlusal adjustments

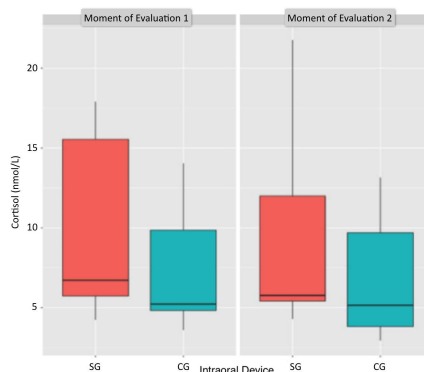


Figure 3 - Athlete preparing the shot in the 9-hole tournament

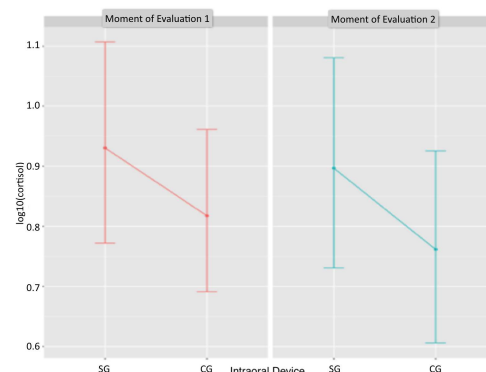
**RESULTS:** The sample was composed of 8 athletes of the CNFGJ, with an average age of 27.3 ( $\pm 7,32$ ) years. The developed model to evaluate the effect of the use of the IOD, evaluation moment and interaction between them with the logarithm of the salivary cortisol concentration shown to be significantly different than the null model ( $\chi^2(3) = 14.752, p < 0.002041$ ), moreover, only the effect of the use of the IOD was shown to influence the model significantly ( $F(1,21) = 15.661, p < 0.0007193$ ). The model developed to evaluate the effect of the IOD, evaluation season and their interaction on the anxiety state showed not to be significantly different from the null model ( $\chi^2(3) = 7.5918, p < 0.05525$ ).

TABLE 1: Minimum, maximum, median, mean and standard deviation values of the salivary cortisol concentration (nmol/L) with and without the use of the IOD (CG and SG) at the two moments of evaluation (CG1, CG2, SG1, SG2)

	Minimum	Maximum	Median	Mean	Standard Deviation
SG1	4.25	17.9	6.725	9.89	5.812
SG2	4.3	21.75	5.775	9.50	6.737
CG1	3.6	14.05	5.225	7.35	3.881
CG2	2.95	13.15	5.15	6.65	3.796



GRAPH 1: Box plot Graph of quartiles related to the concentration of salivary cortisol (nmol/L) with and without the use of the IOD in the two moments of evaluation



GRAPH 2: Main effects of the use of IOD and moments of evaluation relative to the log10 concentration of salivary cortisol

**DISCUSSION AND CONCLUSION:** The use of IOD decreased salivary cortisol levels with statistical significance, however no effect was observed in subjective anxiety levels. The observed effects on cortisol levels may be due to the fact that the athletes close their teeth with the IOD that will be related to a reduced response to stress because the greater competence to close the teeth leads to a decrease in mandibular stress. This stress is channeled through the motor area of the brain which in turn affects the hypothalamo-hypophyseal-adrenal axis, leading to a decrease in the stress response (3). In order to clarify these results the authors propose the extension of the sample and to follow the athletes for a longer period of time.

**References:**

- (1) Okeson, J. P. (2013). *Management of Temporomandibular Disorders And Occlusion* (Vol. 7th).
- (2) Tahara, Y, Sakurai, K, & Ando, T. Influence of chewing and clenching on salivary cortisol levels as an indicator of stress. *J Prosthodont* 16: 129–135, 2007.
- (3) Garner, D. P., Dudgeon, W. D., & Mcdivitt, E. J. (2011). The effects of mouthpiece use on cortisol levels during an intense bout of resistance exercise. *Journal of Strength and Conditioning Research*, 25(10), 2866–2871.

**Acknowledgments:** The authors would like to acknowledge all the athletes and collaborators at the CNFGJ.