

CONTACT Júlio Fonseca  jfonsecas@hotmail.com

Acknowledgements

The authors have no funding sources or conflict of interests to declare.

References

- [1] Isberg-Holm AM, Westesson PL. Movement of disc and condyle in temporomandibular joints with clicking. An arthrographic and cineradiographic study on autopsy specimens. *Acta Odontol Scand.* 1982;40(3):151–164.
- [2] De Leeuw R, American Academy of Orofacial Pain. Orofacial pain: guidelines for assessment, diagnosis, and management. 4th ed. 2008, Chicago: Quintessence. ix, 316 p.
- [3] Minagi S, et al. A manipulation technique for treatment of anterior diskdisplacement without reduction. *J Prosthet Dent.* 1991;65(5):686–691.

The influence of intraoral devices in salivary cortisol levels of golf athletes – a pilot study

Pedro Cebola^a, Vera Chéroux^a, Luis Xavier Santos^a, Alexandra Bernardo^{a,b}, Carlos Família^{a,b}, André Almeida^{a,b}, Sérgio Félix^{a,b}, José Martins do Santos and Catarina Godinho^{a,b}

^aInstituto Superior de Ciências da Saúde Egas Moniz (ISCSEM), Caparica, Portugal; ^bCentro de Investigação Interdisciplinar Egas Moniz, Cooperativa de Ensino Superior, C.R.L., 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 demonstrated by some researchers, and suggested to reduce cortisol levels due 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 in Golf athletes.

Materials and methods: After study approval by the Ethic Commission of the Cooperativa de Ensino Superior Egas Moniz, athletes from the Centro Nacional de Formação de Golfe do Jamor were invited to participate in this study. Following the informed consent a Diagnostic Criteria for Temporomandibular Disorder was applied. Inclusion criteria: Athletes of both genders who have signed informed consent with handicap <20 or professional. Exclusion criteria: Athletes who were under pharmacological treatment with glucocorticoids or anti-inflammatories; altered function of the adrenal glands; Kennedy-Applegate Class I or II. In order to ensure anonymization all data were coded. Individualized intraoral devices (IOD) were developed for each athlete. Athletes held a 9-hole tournament with two phases: one phase without and another with the use of the IOD. 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. Linear mixed effect models were used to evaluate the effect of the use of the intraoral device, evaluation moment and interaction between them and the logarithm of salivary cortisol and anxiety levels. Significance of these effects was assessed through the analysis of variance of type III with Kenward-Roger approximation for degrees of freedom.

Results: The sample was composed of 8 athletes, with an average age of 27.3 (± 7.3) 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 ($\chi^2(3) = 14.752, p < .002$), moreover, only the effect of the use of the IOD was shown to influence the model significantly ($F(1,21) = 15.661, p < .0007$). 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 ($\chi^2(3) = 7.5918, p < .055$).

Discussion and conclusion: The use of IOD decreased salivary cortisol levels, but didn't change in subjective anxiety levels. These effects over the level of cortisol may result from the athletes closing their teeth with IOD due to a reduced response to stress [3]. Most significant larger samples are required to confirm these results.

CONTACT Pedro Cebola  Cebola_ped@hotmail.com

Acknowledgments

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

References

- [1] Okeson JP. Management of temporomandibular disorders and occlusion, Vol. 7th; 2013.
- [2] Tahara Y, Sakurai K, Ando T. Influence of chewing and clenching on salivary cortisol levels as an indicator of stress. *J Prosthodont.* 2007;16:129–135.
- [3] Garner DP, Dudgeon WD, Mcdivitt EJ. The effects of mouthpiece use on cortisol levels during an intense bout of resistance exercise. *J Strength Condition Res.* 2011;25(10):2866–2871.

The influence of intraoral devices on dynamic performance of golf athletes – a pilot study

Vera Chéroux^a, Pedro Cebola^a, Luís Xavier Santos^a, André Almeida^{a,b}, Carlos Família^{a,b}, Catarina Godinho^{a,b} and Sérgio Félix^{a,b}

^aInstituto Superior de Ciências da Saúde Egas Moniz (ISCSEM), Caparica, Portugal; ^bCentro de Investigação Interdisciplinar Egas Moniz (CiiEM), Cooperativa de Ensino Superior, C.R.L., Caparica, Portugal

Introduction: It is widely accepted that the putt in golf depends primarily on the expertise, concentration, and postural control of the performer, in which, stabilization of the mandibular position is of great importance. Previous studies have shown that this stabilization can be optimized with the use of removable intraoral devices that allow precise contact of the teeth from the two arches [1]. Herein we report influence of the use of intraoral devices (IOD) in the putt performance of golf athletes.

Materials and methods: After study approval by the Ethic Commission of the Cooperativa de Ensino Superior Egas Moniz, athletes from the Centro Nacional de Formação de Golfe do Jamor (CNFGJ) were invited to participate in this study. Following the informed consent a Diagnostic Criteria for Temporomandibular Disorder (DC/TMD) was applied. Individualized IOD were developed for each athlete. Athletes were evaluated at two different stages: (a) initial phase (IP) – on the first day of application of the IOD; and (b) adaptation phase (AP) – after 1 week of frequent use of the IOD. In both cases, 20 putts were analyzed with and without IOD. Sam PuttLab (Science & Motion GmbH) was used for task analysis and performance recording. Linear mixed effects models were used to analyze the effects of the utilization of the IOD and adaptation stage in the balls' distance to the hole (BDH), in the percentage of putt success (PPS), and several measures of technique (club angle on impact, local of impact and club trajectory). The significance of these effects was assessed through the analysis of variance of type III with Kenward-Roger approximation for degrees of freedom.

Results: In this study, 17 volunteer golf athletes were included, 88% (15) were male and the average age was 26.2 (± 6.74) years. The developed linear mixed effects models for BDH and PPS shown to be significantly different from the null model ($\chi^2(3) = 9.6314, p \leq .022$ and $\chi^2(3) = 8.194, p \leq .042$, respectively). Analysis of variance shown the interaction between the use of the IOD and the adaptation stage to affect significantly the BDH ($F(1,34) = 2.128, p \leq .034$), reducing in average 6.78 cm the BDH from the IP without IOD to the AP with IOD. Moreover, it also shown that the use of IOD affects significantly the PPS ($F(1,34) = 7.8140, p \leq .008454$), increasing in average 1.6% the PPS.

Discussion and conclusions: Our results show that after reaching a balance period of use with an IOD with the purpose of increasing the stabilization of the mandibular position, there was a significant improvement in accuracy, although there have not been changes in technique of the putt, leading to 1.6% increase in putt accuracy and a decrease of 6.78 cm in the distance of the balls close to the hole. Our results confirm Pae and coworkers' findings describing that the use of IOD promotes an improvement in both isokinetic muscular strength and mental capacity for concentration at the time of impact of the golf club with the ball, which leads to greater precision of movement [2].

CONTACT Vera Chéroux  veracheroux@gmail.com

Acknowledgments

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

References

- [1] Okeson JP. Management of temporomandibular disorders and occlusion, Vol. 7th; 2013.
- [2] Pae A, Yoo R, Noh K, et al. The effects of mouthguards on the athletic ability of professional golfers. *Dental Traumatol.* 2013;29:47–51.