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Original Research

Salivary Cortisol Levels and Periodontal Condition of Chemical Dependent Patients

Níveis de Cortisol Salivar e Condição Periodontal de Pacientes Dependentes Químicos

Niveles de Cortisol Salival y Condición Periodontal de Pacientes Dependientes de Sustancias Químicas

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Abstract

Background: Drug addiction can harm oral health, as the use of illicit substances can reduce salivary flow and the buffering capacity of saliva, facilitating the development of periodontal disease. Salivary cortisol levels can influence oral health, as increased levels of this hormone may be related to a decreased immune response, affecting periodontal tissues. Objective: To evaluate salivary cortisol levels and their relationship with the periodontal condition of chemical dependent patients. Methods: The study was carried out on 60 institutionalized chemical dependent patients. Data on sociodemographic characteristics were collected through interviews and periodontal condition was assessed using the Community Periodontal Index. Analysis of salivary cortisol levels was performed using the ELISA method. Results: Of the 360 mouth sextants, 59 (16.39%) were healthy; 69 (19.17%) had bleeding on probing; 75 (20.83%) had dental calculus; 79 (21.94%) had periodontal pockets; and 78 (21.67%) were excluded. The average number of healthy sextants was 0.98±1.83; of sextants with bleeding on probing was 1.15±1.64; of sextants with dental calculus was 1.25±1.78; of sextants with periodontal pocket was 1.32±1.71; and of excluded sextants it was 1.28±1.91. The concentration of salivary cortisol was significantly higher (p=0.0015) in patients who had at least one sextant with gingival bleeding (89.31±96.06) compared to those who did not have gingival bleeding (23.96±29.09). Conclusion: The patients presented severe damage to their periodontal condition and those with gingival bleeding had a higher concentration of salivary cortisol.

Descriptors: Drug Users; Periodontal Diseases; Hydrocortisone; Public Health.

Resumo

Introdução: A dependência química pode prejudicar a saúde bucal, pois o uso de substâncias ilícitas pode reduzir o fluxo salivar e a capacidade tampão da saliva, facilitando o desenvolvimento da doença periodontal. Os níveis de cortisol salivar podem influenciar a saúde bucal, pois o aumento dos níveis desse hormônio pode estar relacionado à diminuição da resposta imunológica, afetando os tecidos periodontais. Objetivo: Avaliar os níveis de cortisol salivar e sua relação com a condição periodontal de pacientes dependentes químicos. Métodos: O estudo foi realizado com 60 pacientes dependentes químicos institucionalizados. Os dados sobre as características sociodemográficas foram coletados por meio de entrevistas e a condição periodontal foi avaliada por meio do Índice Periodontal Comunitário. A análise dos níveis de cortisol salivar foi realizada pelo método ELISA. Resultados: Dos 360 sextantes bucais, 59 (16,39%) estavam saudáveis; 69 (19,17%) apresentaram sangramento à sondagem; 75 (20,83%) apresentavam cálculo dentário; 79 (21,94%) apresentavam bolsa periodontal; e 78 (21,67%) foram excluídos. O número médio de sextantes saudáveis foi 0,98±1,83; o número de sextantes com sangramento à sondagem foi 1,15±1,64; de sextantes com cálculo dentário foi 1,25±1,78; de sextantes com bolsa periodontal foi 1,32±1,71; e dos sextantes excluídos foi 1,28±1,91. A concentração de cortisol salivar foi significativamente maior (p=0,0015) nos pacientes que tiveram pelo menos um sextante com sangramento gengival (89,31±96,06) em comparação aos que não tiveram sangramento gengival (23,96±29,09). Conclusão: Os pacientes apresentaram graves prejuízos na condição periodontal e aqueles com sangramento gengival apresentaram maior concentração de cortisol salivar.

Descritores: Usuários de drogas; Doenças periodontais; Hidrocortisona; Saúde pública.

Resumen

Introducción: La drogadicción puede perjudicar la salud bucal, ya que el uso de sustancias ilícitas puede reducir el flujo salival y la capacidad amortiguadora de la saliva, facilitando el desarrollo de la enfermedad periodontal. Los niveles de cortisol salival pueden influir en la salud bucal, ya que los niveles elevados de esta hormona pueden estar relacionados con una respuesta inmune disminuida, afectando los tejidos periodontales. Objetivo: Evaluar los niveles de cortisol salival y su relación con la condición periodontal de pacientes químicamente dependientes. Métodos: El estudio se realizó con 60 pacientes drogodependientes institucionalizados. Los datos sobre las características sociodemográficas se recopilaron mediante entrevistas y la condición periodontal se evaluó mediante el Índice Periodontal Comunitario. El análisis de los niveles de cortisol salival se realizó mediante el método ELISA. Resultados: De los 360 sextantes bucales, 59 (16,39%) estaban sanos; 69 (19,17%) presentaron sangrado al sondaje; 75 (20,83%) tenían cálculo dental; 79 (21,94%) tenían bolsas periodontales; y 78 (21,67%) fueron excluidos. El número medio de sextantes sanos fue 0,98+1,83; el número de sextantes con sangrado al sondaje fue 1,15±1,64; de sextantes con cálculo dental fue 1,25±1,78; de sextantes con bolsa periodontal fue 1,32±1,71; y de los sextantes excluidos fue 1,28±1,91. La concentración de cortisol salival fue significativamente mayor (p=0,0015) en los pacientes que tenían al menos un sextante con sangrado gingival (89,31±96,06) en comparación con aquellos que no tenían sangrado gingival (23,96±29,09). Conclusión: Los pacientes presentaron pérdidas graves en condición periodontal y aquellos con sangrado gingival presentaron mayor concentración de cortisol salival.

Descriptores: Consumidores de Drogas; Enfermedades Periodontales; Hidrocortisona; Salud Pública.

INTRODUCTION

Chemical dependence is a chronic disease characterized by the compulsive use of psychoactive chemical substances, which can result in the development of severe side effects, such as compulsivity and abstinence. According to the 2022 World Drug Report, developed by the United Nations Office on Drugs and Crime (UNODC), there was a 26% increase in the use of psychoactive substances in individuals aged 15 to 64 in the last 10 years, with emphasis on marijuana and cocaine. Moreover, the impact generated by

the COVID-19 pandemic also resulted in an increase in the search for hallucinogenic substances, in an attempt to face social distancing and its direct impacts on mental health[1,2]. In this way, chemical dependency and its relationship with mental health are themes closely related to the expanded concept of health, since accurate diagnosis and care for psychophysiological disorders enable greater engagement in the rehabilitation process[1].

Compulsive drug use is directly related to the levels of stress to which the individual is subjected, as long as stressful events can be considered risk factors for the development of neuropsychiatric disorders, in addition to precursors to illicit drug use[3]. In this way, the analysis of salivary cortisol levels is a method that allows evaluating the degree of stress to which the body is subjected. This hormone exerts a negative feedback on the secretion of adrenocorticotropin and corticotropin during the action of stressful symptoms in the hypothalamus, helping the body to control stress, as well as maintaining other systems that are fundamental to the functioning of human metabolism[4,5]. Assessing the degree of stress is important, since situations of chronic stress can cause an increase in the level of glucocorticoids, resulting in immunosuppressive effects and creating opportunities for the emergence of infectious diseases[6]. For that matter, the periodontal condition can be directly impacted, since a lower immunological response affects the development of granulation tissue and the recovery process of periodontal tissues[7, 8].

Furthermore, most drug addicts have factors such as poor nutrition, poor oral hygiene practices and restricted access to dental services, which can harm periodontal health[9]. It is also important to highlight that opioid chemicals interfere with the repair and regeneration of periodontal tissue at a molecular level and may contribute to the emergence of periodontal diseases[9]. Thus, due to these aspects, the accumulation of bacterial biofilm in these patients is common and, as this is one of the main agents related to the impairment of periodontal health, the susceptibility of drug addicts to periodontal disease is established. Another aggravating factor is that the use of legal and illicit substances, such as tobacco, alcohol, crack, cocaine and tetrahydrocannabinol, trigger cholinergic effects such as reduced salivary flow[10]. This leads to a reduction in the buffering capacity of saliva, which facilitates the development of oral disorders, such as tooth decay and periodontal disease[11, 12].

The objective of this study was to investigate the relationship between salivary cortisol levels and periodontal health status in institutionalized drug-dependent patients.

MATERIAL AND METHOD

This is an observational, analytical, cross-sectional and quantitative study that was conducted on institutionalized chemical dependent patients residing in a specialized treatment center, in the year 2023. The study included patients of both sexes; aged 18 or over; with a history of chronic use of illicit drugs; and that there were no diseases in the salivary glands. Individuals who presented any physical condition that made it impossible to perform a clinical oral examination were excluded from the research; those who are not lucid enough to understand the purpose of the study and respond to the survey; and those who do not agree to participate in the research. All patients who met the eligibility criteria were invited to participate in the study.

The sample size was determined based on data obtained from a pilot study, considering the estimated prevalence of periodontal disease in this target population as the main outcome. Thus, considering the total number of individuals residing in the treatment center and adopting a confidence level of 95%, an acceptable margin of error of 5% and an expected proportion of periodontal disease of 80%, a minimum sample size of 30 patients was determined to compose the study sample. The sample size was expanded to 60 patients, in order to achieve the statistical power necessary to find the predicted relationships.

Information on the patients' sociodemographic characteristics was obtained through interviews, using a semi-structured questionnaire. Periodontal condition was assessed using the Community Periodontal Index. Clinical examinations were carried out by a single examiner, previously calibrated, in an adequately ventilated and illuminated place in the courtyard of the treatment center, using natural light, a flat mouth mirror and a World Health Organization (WHO) periodontal probe, using the codes and criteria presented in the fifth edition of the Oral Health Surveys: Basic Methods from the World Health Organization (WHO)[13]. The Kappa coefficient was calculated to verify intra-examiner agreement, obtaining a value of 0.92.

To carry out the analysis of salivary cortisol levels, there was carried out scheduled and systematic collections of saliva samples from patients. Sample collection was carried out between 8 and 9 am, in order to avoid contamination of the sample by food residues and interference due to conditions inherent to the circadian cycle. It should be noted that, in the case of institutionalized patients, the participants had the same sleeping and waking times, in accordance with the institution's rules. Study participants were instructed not to brush their teeth or consume any type of drink

or food within one hour before collection. Saliva samples were collected in sterilized graduated tubes and centrifuged at 5500×g, for 10 minutes, at 4ºC, and the supernatant was extracted and kept in a freezer at -70ºC until analysis. The analysis of salivary cortisol concentrations was carried out using the ELISA method (Enzyme Linked Immuno Sorbent Assay).

The data were analyzed using descriptive statistics techniques and the results were presented through tables and graphs. The normality of salivary cortisol concentration data was analyzed using the D'Agostino-Pearson test.

Patients were divided into two groups, according to the presence of at least one sextant with gingival bleeding. The comparison of salivary cortisol concentration between patients who had gingival bleeding and those who did not have any sextant with gingival bleeding was performed using the Mann-Whitney test. Data processing was carried out using the Bioestat software version 5.0, adopting a significance level of 5%.

The study was submitted and approved by the Human Research Ethics Committee (CAAE Process number: 57639722.9.0000.5420) and was conducted in accordance with the standards of the Declaration of Helsinki. Free and Informed Consent was obtained from all participants.

RESULTS

In total, 60 institutionalized drug-dependent patients with a mean age of 41.12 ± 13.74 years were examined. All patients were male and, as shown in Table 1, most patients had white skin color (66.67%), were single (78.33%) and did not complete high school (53.33 %).

Table 1. Absolute and percentage distribution, according to the sociodemographic profile variables of institutionalized drug-dependent patients. Araçatuba, SP, 2023.

Variable	n	%
Self-declared skin color		
White	40	66.67
Black	13	21.67
Brown	7	11.67
Civil status		
Married	12	20.00
Single	47	78.33
No information	1	1.67
Schooling		
Incomplete primary school	16	26.67
Complete primary school	3	5.00
Incomplete high school	13	21.67
Complete high school	20	33.33
Incomplete higher education	8	13.33
TOTAL	60	100.00

Table 2 shows that, of the total 360 oral sextants examined, the smallest portion was healthy (16.39%), while most sextants (83.61%) had some alteration in their periodontal condition, including gingival bleeding on probing, dental calculus, periodontal pockets or exclusion due to having fewer than two functional teeth present.

Analysis of the distribution of sextants per patient showed that only 2 patients had sextants with healthy periodontal conditions (Table 3). It is noteworthy that half of the patients had at least one sextant with a periodontal pocket and that more than 40% of them had at least one sextant excluded because they had less than two functional teeth present.

Table 2. Absolute and percentage distribution of the oral sextants of institutionalized drug addict patients, according to periodontal condition. Araçatuba, SP, 2023.

Periodontal Condition	n	%
Healthy sextants	59	16.39
Sextants with bleeding on probing	69	19.17
Sextants with dental calculus	75	20.83
Sextants with periodontal pockets	79	21.94
Excluded sextants	78	21.67
TOTAL	360	100.00

Table 3. Absolute and percentage distribution of institutionalized drug addict patients according to periodontal condition. Araçatuba, SP, 2023.

Periodontal condition	n	%
Only healthy sextants	2	3.33
At least 1 sextant with bleeding on probing	29	48.33
At least 1 sextant with dental calculus	28	46.67
At least 1 sextant with periodontal pocket	30	50.00
At least 1 excluded sextant	25	41.67
Total	60	100.00

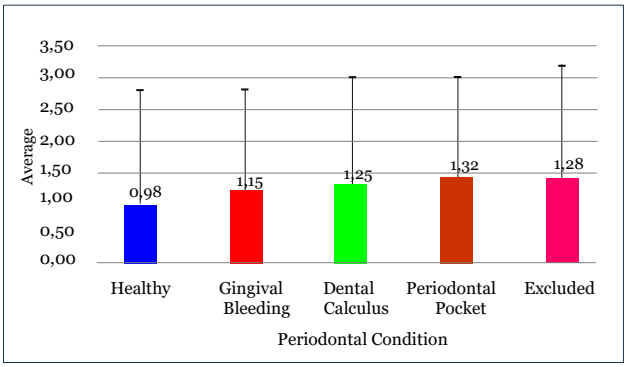

Figure 1. Average and standard deviation of oral sextants per patient, according to sextant condition. Araçatuba, SP, 2023.

Salivary cortisol concentration was significantly higher (p=0.0015) in patients who had at least one sextant with gingival bleeding compared to those who did not have gingival bleeding (Figure 2).

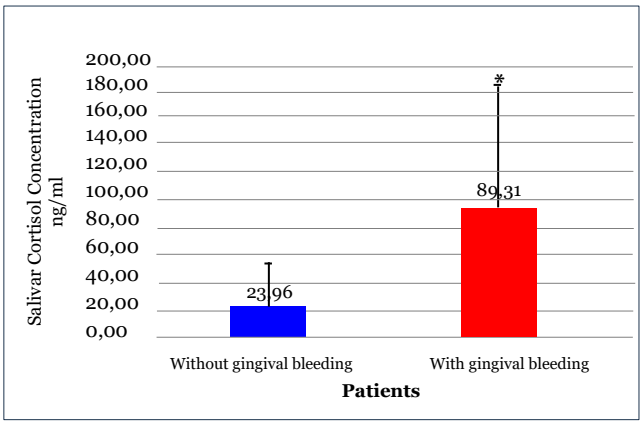

Figure 2. Average and standard deviation of salivary cortisol concentration, according to the presence of gingival bleeding. Araçatuba, SP, 2023.

DISCUSSION

This study found that almost all the participants had at least one oral sextant with some periodontal alteration and that patients with gingival bleeding had a higher salivary cortisol concentration.

Analysis of the participants' sociodemographic profile showed that the vast majority were single. In this context, the results of a recent systematic review suggest that loneliness may be related to physical and mental health problems and illicit substance use, highlighting the importance of developing multidimensional measures and interventions for coping with loneliness that meet the specific needs of people with illicit substance use problems[14]. In this way, it is possible to suggest that the lack of marital support may have contributed to the participants' entry into the world of drugs.

The evaluation of the sociodemographic profile also showed that the participants had a low level of education. This finding corroborates the results of other studies which have also found a lower level of education to be a characteristic of the profile of patients who use illicit drugs[15,16]. Thus, the need to implement educational measures and awareness actions to prevent drug use in the first years of educational training is evident, as well as using mass media as a possible strategy to reach the population outside the school environment.

From the analysis of the results of oral clinical examinations, it was observed that, of the total number of oral sextants examined, there was a reduced proportion of healthy sextants, while the majority of sextants presented changes of varying degrees and severity in the periodontal condition, including bleeding at the probing, dental calculus, periodontal pocket and sextants excluded from the examination due to the presence of less than two remaining dental elements. These findings are in line with literature data, which demonstrate the association between the use of illicit drugs and adverse oral effects, such as tooth decay, periodontal disease, bruxism, poor oral hygiene and neglect of oral health. Furthermore, other factors, such as a highly cariogenic diet and lifestyle, aggravate the fragile oral health condition of illicit drug users[12,17]. Thus, the importance of the role of the dentist as an essential component in the management and rehabilitation of the health of these individuals is reinforced.

It should be noted that the combination of poor-quality oral hygiene and neglect of systemic health can create an environment conducive to the emergence of unfavorable oral conditions, such as the accumulation of dental biofilm and the presence of dental calculus, which lead to the development of periodontal disease. Furthermore, another important factor, which contributes to the emergence and worsening of oral diseases, is the reduction in salivary flow and the buffering capacity of saliva, oral changes frequently presented by drug-dependent patients[11].

When individually evaluating the participants regarding the periodontal condition of their mouth sextants, it was found that only two of them had all their mouth sextants healthy. Thus, almost all participants had at least one sextant with bleeding on probing, dental calculus or periodontal pockets. In this sense, periodontal bleeding on probing is the result of the periodontal tissue's response to slight contact with the instrument used to perform the examination, characterizing a condition in which the gingival tissue is in an active inflammatory process. It is important to highlight that, with appropriate and timely actions, through guidance and interventions from the dentist and the improvement of the quality of the patient's oral hygiene, gingivitis is a clinically reversible condition, different from more advanced stages of periodontal diseases, such as periodontitis, which can result in important sequel, such as alveolar bone loss[18].

The existence of dental calculus, observed in a considerable portion of the sextants examined, is related to the evolution of periodontal disease, alveolar bone loss and loss of periodontal attachment, which may trigger the beginning of periodontal pocket formation[19,20]. In this context, it is highlighted that access to dental services to remove dental calculus is of fundamental importance to stop the progression of periodontal disease, preventing the emergence of periodontal pockets and tooth mobility.

It is important to highlight the large presence of sextants excluded due to the reduced number of functional teeth present, representing more than 20% of the total oral sextants examined and being present in more than 40% of the participants. Considering the history of periodontal disease progression, the loss of a tooth represents the most advanced stage of the disease, suggesting a lack of access to dental services and possible treatments that could be performed to avoid this outcome. A longitudinal study carried out to evaluate tooth loss related to periodontitis over 40 years and highlighted the importance of early treatment of periodontitis, together with smoking cessation, in people under 30 years of age, further showing that removal of dental calculus, control of bacterial biofilm and control of gingivitis are essential in preventing disease progression, loss of periodontal attachment and tooth loss[21].

In the present study, it was found that the concentration of salivary cortisol was significantly higher in patients who had at least one sextant with gingival bleeding, compared to those who did not have gingival bleeding. Similarly, a study conducted on patients with varying degrees of periodontitis,

evaluating anxiety levels and salivary cortisol concentration, found a relationship between salivary cortisol levels and severe chronic periodontitis and between salivary cortisol levels and stress[22]. Additionally, findings from a meta-analysis study suggest that individuals with aggressive periodontitis have higher levels of salivary cortisol than healthy individuals or patients with chronic periodontitis[23]. This difference in the salivary cortisol response can have a negative impact on the periodontium, contributing to worsening the burden of aggressive periodontal disease[23,24]. Therefore, it is possible to suggest that there is a relationship between the stress situation, common during an addiction treatment process chemistry, and an increase in salivary cortisol levels, which may be reflected in the periodontal condition of these patients. The findings of this research reinforce literature data that indicate an important relationship between the use of illicit drugs and periodontal disease, highlighting the relevance of support and counseling to facilitate the successful cessation of illicit drug use[25-27].

CONCLUSION

It is concluded that institutionalized drug-dependent patients presented severe losses in their periodontal condition, highlighting the reduced proportion of healthy sextants and the large number of sextants with periodontal pockets or excluded due to the small number of remaining functional teeth; and patients with gum bleeding had a higher concentration of salivary cortisol.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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