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The Relation Between High Levels of Hydrocortisone in Saliva and Periodontic Condition in Anxiety

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Dr.Alia Taboor Thijeel
Technical Medical Institute
Middle Technical university

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Abstract

Periodontitis and anxiety are two topics that have gotten much attention in the last two decades. Early discovery of these disorders is critical for successful treatment. Hydrocortisone is a protein that has been discovered to be consistently linked to both.This investigation was intended to compare SCLs of saliva hydrocortisone between CP patients who reported experiencing anxiety and those who did not. In this cross-sectional investigation, saliva samples from 92 individuals were collected and analyzed for hydrocortisone levels using the ELISA technique. Class 1 consisted of participants with no periodontitis and no anxiety, Class 2 included those with periodontitis but no anxiety, Class 3 included those without periodontitis but with anxiety, and Class 4 included those with no periodontitis but high anxiety (with periodontitis and anxiety). A total of 92 adults (41 men and 51 women) participated in the research. The mean SCL for participants in Class 4 (Class 4: 60.13± 6.68) is significantly higher than the mean SCL for participants in Class 1 (15.01 ± 2.62), Class 2 (31.92 ±6.80), Class 3 (34.47 ±13.47), and Class 2. When looking at Class I, we see a negative link between hydrocortisone and BOP, anxiety and PI, and anxiety and hydrocortisone level, whereas Class 4 reveals a positive correlation between SCL and PD that is not statistically significant. The SCL analysis revealed class-specific differences. Both CP and psychological anxiety were linked to SCL. The SCL is amplified by inflammation and stress.

1. Introduction

Chronic periodontitis (CP) is a multidimensional illness characterized by a complicated interaction between bacterial invasion and host reaction, with bacterial dental biofilms regarded as the primary aetiological causes of infection starts. (Refulio, Rocafuerte, de la Rosa, Mendoza, & Chambrone, 2013) The combination between immune activation and stimulation to systemic and environmental characteristics causes disease progression and severity. Systemic disorders, genetic mutations, socioeconomic conditions, tobacco plant use, and mental anxiety are all potential risk factors for periodontitis. (R. J. Genco, 1996)

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Even though the term "anxiety" is constantly being reinterpreted in the technical analysis of sickness and disease, it is a proven and crucial role in the etiology and preservation of numerous provocative illnesses, as well as periodontic infection. The research on anxiety and periodontic infection aim at psychological anxieties and their effects on gingival disease exposure and/or the provocative features of the periodontic disease. (LeResche & Dworkin, 2002) Anxiety phenomenology has been developed into proof-based prototypes associating anxiety with periodontic illness. (da Silva, Newman, & Oakley, 1995; R. J. Genco et al., 1998) Anxiety factors from psychological and physical dimensions provide hazard variables for periodontic infection. (R. J. Genco, 1996)

The body's "anxiety system," the hypothalamic-pituitary-adrenal axis (HPA axis), controls the hormone hydrocortisone and other substances involved in the emotional response to stress. In response to inflammatory, physiological, and psychological stresses, the body releases hormones via the HPA axis to protect the host and maintain homeostasis. Anxiety triggers production of a corticotrophin-releasing substance in the hypothalamus paraventricular nucleus, which then acts on the pituitary gland. Adrenocorticotrophic hormone is secreted by the pituitary gland in response, which stimulates the adrenal cortex to increase its output of hydrocortisone into the circulation. The body's internal clock, located in the hypothalamus or suprachiasmatic nuclei, regulates the release of hydrocortisone by stimulating the HPA axis at regular intervals. (R. J. Genco, 1996)

One of the most important glucocorticoids, hydrocortisone is produced by the adrenal cortex. It inhibits lymphocyte synthesis and triggers hyperplasia of lymphatic tissue, demonstrating potent anti-inflammatory and immunosuppressive properties. Since antibody formation is inhibited at the same time, humoral immune defense is greatly diminished. Hydrocortisone's antiphlogistic properties stem from its ability to inhibit fibroblast proliferation in granulation tissue formed in response to inflammation. Production of several inflammatory cytokines will be reduced. Disturbance of homeostasis results from hydrocortisone's effect on the immune system. (Hagan, Poole, & Bristow, 1992)

Biomarker studies in periodontitis and anxiety have previously made use of gingival crevicular fluid (a serum transudate), serum, and more recently, saliva.

Hydrocortisone in saliva (Ardila & Guzmán, 2016; Rai, Kaur, & Anand, 2012) (1) signifies "free" natural bioactive hydrocortisone, (2) is unchanged by salivary stream amount, (3) reliably and consistently imitates permitted serum hydrocortisone and HPA axis responsiveness, and (4) is an extra hands-on evaluation tool in anxiety research than venipuncture due to its potency to arouse spurious increment in hydrocortisone emission reflecting a "hyper anxiety" constituent. (Nejtek, 2002)

As a result, the current study attempted to assess the relationship between anxiety, CP, and salivary hydrocortisone.

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2. Material and Methodology

The Section of Periodontics at Saint Raphael (Al Rahibat) Hospital in Baghdad, Iraq, conducted a clinical-biochemical study to examine the relationship between anxiety, salivary hydrocortisone, and CP. The study was carried out with the agreement of the Institutional Ethics Review committee. Participants must be between the ages of 30 and 60, have more than 20 teeth, be free of systemic disorders and drugs, and have not obtained periodontic therapy in the last 7 months. The study excluded expectant and breastfeeding women.

A sum of 300 affected roles was assessed over 6 months, with only 136 members accepted into the research focusing on exclusion and inclusion criteria. Constructed on the oral, periodontic evaluation, and pressure survey, the contributors were divided into 4 Classes: Class 1 (no anxiety and no periodontitis [Figure 1]) - 36 participants, Class 2 “CP and no anxiety” - 34 participants, Class 3 “anxiety and no periodontitis” - 24 participants, and Class 4 “anxiety and periodontitis” - 22 members. Simple randomization was used to choose 22 people from each Class, and saliva was collected to estimate salivary levels of hydrocortisone [Figure 3].

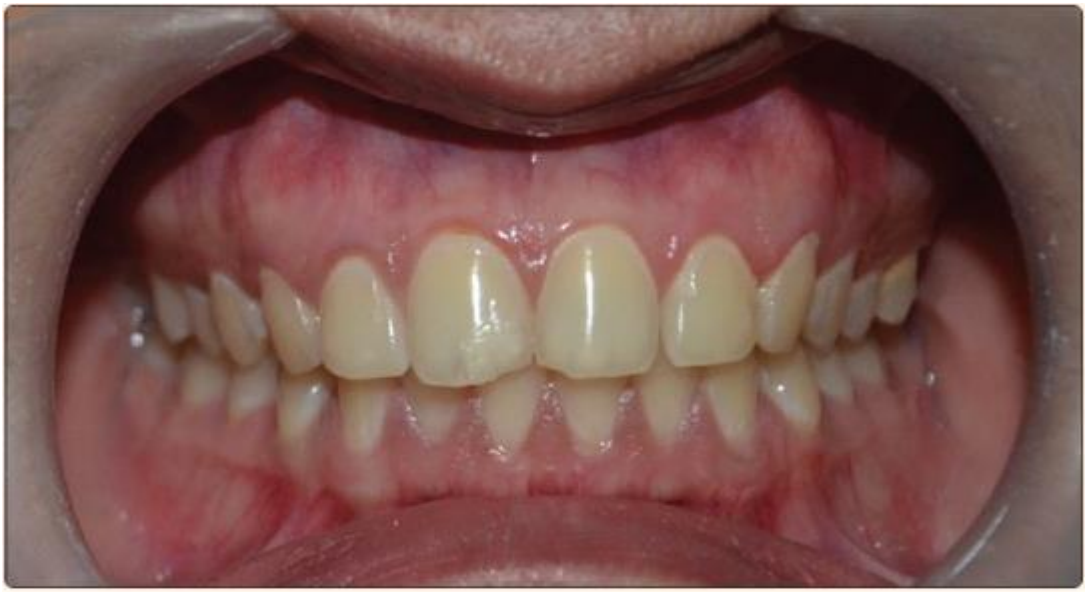

Figure 1: Healthy periodontic condition

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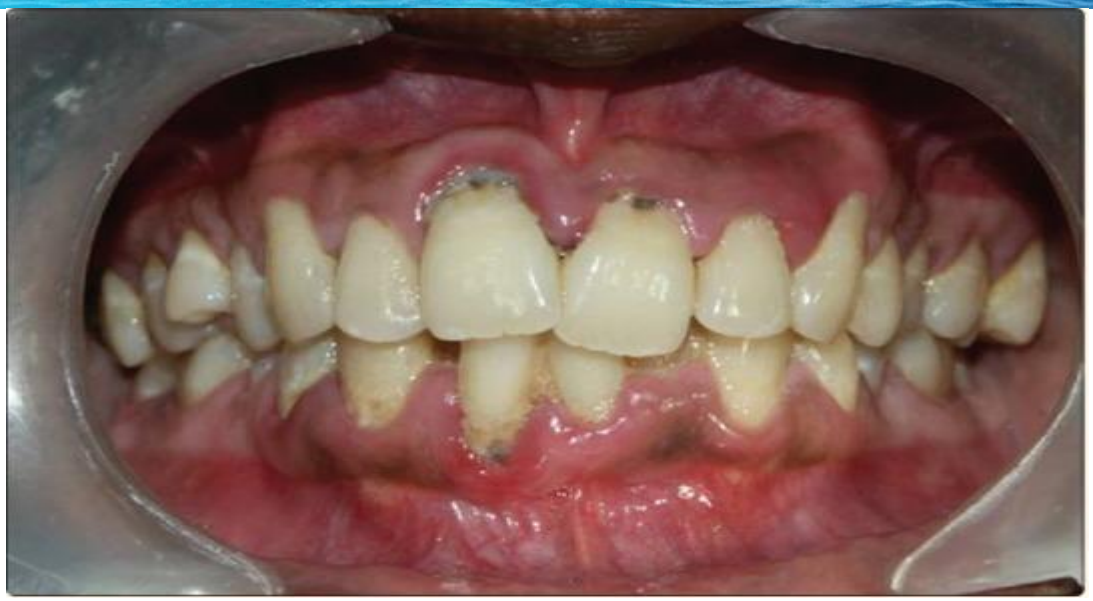

Figure 2: Chronic periodontitis

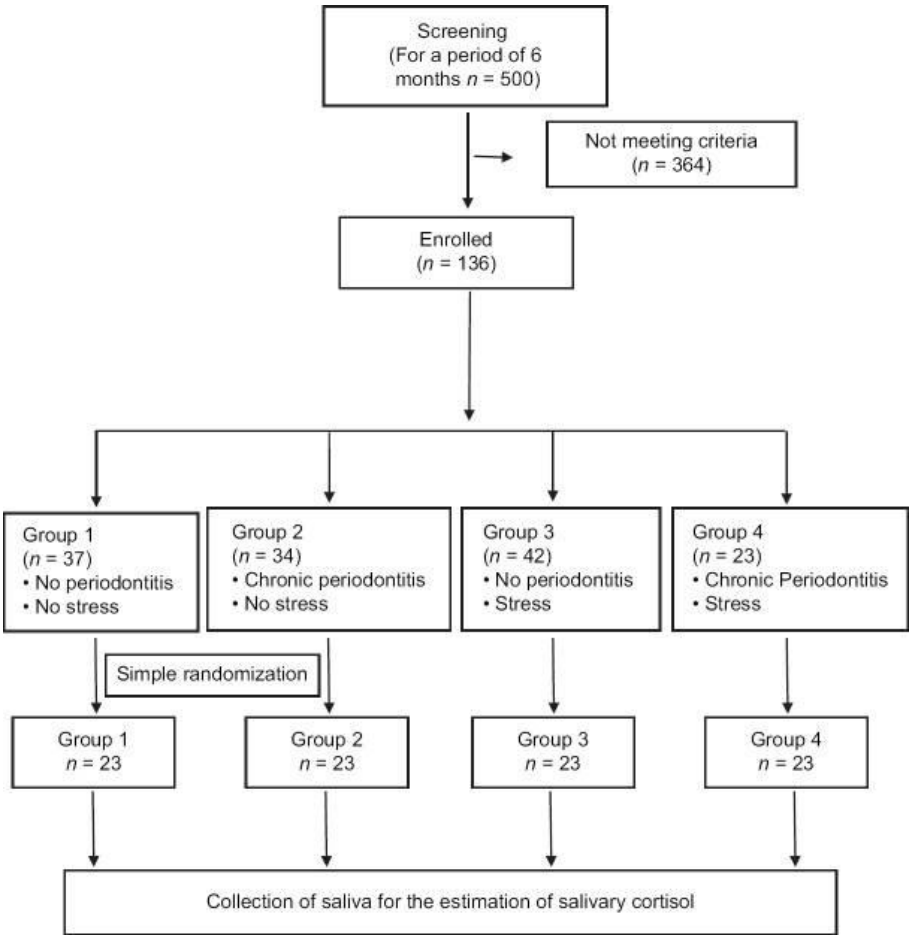

Figure 3: "Flowchart of study design with Class assignment"

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Every participant in the study was given a thorough explanation of the research's goals and asked for their written consent. Participants were given periodontal exams and anxiety assessments to complete. As stated by (Lovibond & Lovibond, 1995) All individuals' levels of anxiety were measured using questions from the Depression, Anxiety, and Stress Scale-21 (DASS-21). The DASS-21 is a self-report scale with 3 levels to assess anxiety, nervousness, and sadness. Each one of the 3 DASS-21 measures contains 7 items that are further broken into subscales with comparable substances. The hopelessness level assesses dysphoria, pessimism, life depreciation, self-denigration, lack of participation, anhedonia, and lethargy. The anxiety level assesses autonomic stimulation, muscular tissue causes, situational fear, and subjective fear. Compulsive imprecise arousal concentrations are receptive to the anxiety scale. It investigates the ability to relax, anxious alertness, being quickly disturbed, irascible/over-sensitive, and anxious. You sum up the points you receive on the appropriate items to get your total score for melancholy, anxiety, and stress. Gingival inflammation, loss of attachment larger than 3 mm, probing depth greater than 6 mm at 4-5 places in more than four teeth in each quarter, and stress levels were used to categorize competitors into 4 Classes.

2.1. Statistical analysis

Spreadsheet software like Microsoft Excel was used to automatically compile the data. IBM SPSS (Armonk, NY: IBM Corp.) version 21 was used for statistical analysis of all biochemical and clinical values. Fundamental descriptors such as mean and standard deviation were employed. All parameters have normal distributions, as shown by the Shapiro-Wilk test. For this reason, parametric methods were employed for data examination. Multiple Class comparisons were analyzed using analysis of variance, and further pairwise comparisons were conducted using Tukey's post hoc test. The threshold of statistical significance, P 0.05, was maintained throughout all tests.

3. Results

Table 1 displays the standard deviation and means of participants' age, gender, and brushing practices among Classes.

Demographic Variables	Age (Years), mean± SD	Sex		Brushing	
		Males%	Female%	Once%	Twice%
Class 1	42.60±7.32	12 (52.2)	11 (47.8)	9 (39)	14 (60)
Class 2	40.95±7.48	11 (47.8)	12 (52.2)	13 (56)	10 (43)
Class 3	42.08±8.97	9 (39.1)	14 (60.9)	10 (43)	13 (56)
Class 4	45.78±7.82	9 (39.1	14 (60.9)	18 (78)	5 (21)

Table 1: Demographic data representing mean and standard deviation of age, gender, and brushing in different Class

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Table 2 displays the standard deviation and mean of several parameters in different Classes. The mean hydrocortisone level gradually rises from Class 1 to Class 4 (Class 1: 16.01 2.63, Class 2: 32.92 7.80, Class 3: 35.47 14.47, and Class 4: 59.13 5.68). This demonstrates that people suffering from anxiety and periodontitis had elevated mean saliva levels of hydrocortisone (SCLs).

Category	PI	BOP	PD	CAL	Anxiety	Hydrocortisone
Class 1	0.50±0.28	0.41±0.29	1.75±0.18	0	9.13±3.07	15±2.62
Class 2	1.45±0.55	1.90±0.52	4.07±1.01	4.46±0.60	10.8±2.39	31±6.8
Class 3	1.08±0.23	1.44±0.26	2.03±0.25	0	36±3.51	34±13.4
Class 4	2.57±0.31	2.76±0.22	4.84±0.74	5.41±0.79	33.4±5.63	60±6.68

"PI: Plaque Index; BOP: Bleeding on Probing; PD: Probing Length; CAL: Clinical attachment Level"

Table 2: Mean and standard deviation of various parameters in the study Class"

Pearson's correlation test was used to compare salivary hydrocortisone levels with various factors among the Class, as indicated in Table 3. Class, I have a massive negative correlation of hydrocortisone to bleeding on probing "BOP" "0.650, P = 0.005" and a non-significant negative association of hydrocortisone to PD "0.132, P = 0.579". Similarly, there is a non-significant negative connection between hydrocortisone and plaque index (PI) "0.116, P = 0.621" and hydrocortisone and Parkinson's disease "0.086, P = 0.750" in Class 2. The hydrocortisone had a negligible negative connection with PI "0.145, P = 0.559" and BOP "0.023, P = 0.962" in Class 3.

Class	Hydrocortisone to PI	Hydrocortisone to BOP	Hydrocortisone to PD	Anxiety to PI	Anxiety to BOP	Anxiety to PD	Anxiety to Hydrocortisone
Class 1	0.106	-0.560*	-0.1220	-0.608*	0.066	-0.120	-0.492*
Class 2	-0.106	0.148	-0.0076	-0.060	0.283	-0.086	0.04
Class 3	-0.135	-0.013	0.001	0.084	-0.192	0.044	-0.330
Class 4	0.395	0.518	0.309	0.115	-0.054	-0.162	-0.207

Pearson's correlation test * Significant ($p<0.05$)

Table 3: "Comparison of salivary hydrocortisone levels with various parameters within Class"

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"Table 3 provides a comparative analysis of anxiety levels with hydrocortisone and other clinical indicators. In Class 1, there is a substantial negative connection between anxiety and PI (0.618, P = 0.012) and between anxiety and hydrocortisone levels (0.489, P = 0.027). There is a negative association between anxiety and PI (0.1850, P = 0.478) and PD (0.078, P = 0.707) in Class 2, and a nonsignificant link between anxiety and BOP (0.182, P = 0.378) and hydrocortisone (0.340, P = 0.134) in Class 3. Anxiety has an insignificant connection with BOP (0.064, P = 0.826), PD (0.172, P = 0.467), and hydrocortisone levels (0.227, P = 0.354) in Class 4".

Hydrocortisone levels have a positive association with PI "0.385, P = 0.072", BOP "0.538, P = 0.21", and PD "0.329, P = 0.171", and anxiety has a positive correlation with PI "0.125, P = 0.593", all of which are not significant, as shown in Table 3.

4. Discussion

Overall, Class IV had the highest mean PI and BOP ratings in the present investigation. When comparing Classes II and III, Class II has higher mean values for PI and BOP, while Class III has lower mean values. Class I has the highest and lowest mean values, respectively (Hilgert, Hugo, Bandeira, & Bozzetti, 2006; Mannem & Chava, 2012) observed that the reproducibility of the interpersonal and inter-visual PI values and intra-and I

Nevertheless, (Goyal, Jajoo, Nagappa, & Rao, 2011) discovered that plaque levels are connected to anxiety and hydrocortisone. According to Rohini et al. (2015), the anxiety factor has a significant impact on plaques and periodontic disease. (Rohini et al., 2015)

(Cakmak, Alkan, Ozsoy, Sen, & Abdulrezzak, 2014) clinical attachment level, probing depth, gingival index, and mean and median PI values were found to differ significantly across groups (CAL). Similarly, (Croucher, Maecenas, Torres, Hughes, & Sheiham, 1997) found that dental plaque levels and tobacco use cluster together as crucial predictors of periodontitis. Psychosocial variables, such as the influence of life events, occupation, and relationship status, may also be important. In spite of extreme stress related to schoolwork, dental hygiene practices may be accurately predicted by measuring plaque (Deinzer et al., 2005). Anxiety raises plaque levels because it reduces efforts to maintain good oral hygiene.

In conclusion, these results lend credence to the theory put forward by (R. Genco, Ho, Grossi, Dunford, & Tedesco, 1999) that anxiety's effects on dental health may be mediated, at least in part, by anxiety-induced neglect of oral hygiene.

Class IV had the greatest mean PD and CAL, followed by Class II and Class III, and finally Class I had the lowest PD and CAL among the classes studied here. Class I and Class III did not vary from one another statistically. Both PD and CAL measures were shown to have high reproducibility (Hilgert et al., 2006). Quantity and severity of periodontitis, as assessed by PD and CAL, were both associated with hyperhydrocortisoneemia. Prospective research by (Freeman, 1993) found that worries about one's physical health were linked to deeper pockets.

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Researchers (Linden, Mullally, & Freeman, 1996) found no correlation between patients' perceptions of their own health and the onset of periodontitis. Their study was longitudinal and had a small sample size.

Brushing less often did not reduce the risk of developing CP, according to the present study. Researchers found a negative correlation between participants' total anxiety scores and the frequency with which they brushed their teeth in a cross-sectional study (Rosania, Low, McCormick, & Rosania, 2009).

"When anxiety levels were compared between Class, statistical significance was discovered between Class I and III, I and IV, II and III, and II and IV, with Class III having higher mean anxiety scores. There was no statistically significant difference between Class I and II or III and IV. In terms of salivary hydrocortisone levels, statistical significance was discovered between Class I and II, I and III, I and IV, II and IV, and III and IV, with Class IV having higher mean values due to the overlaying of psychological anxiety and CP".

According to "R. Genco, et al., 1999" in a subsample of those with and without periodontic, the average level of salivary hydrocortisone was greater in the CP Class. The current study found that CP related to anxiety had higher periodontic damage and disease severity, with elevated PD, CAL, and clinical signs. This could be due to periodontitis coexisting with anxiety and hydrocortisone, which is one of the risk factors for periodontic.

Recent research has shown that hydrocortisone may be found in the saliva of clinically healthy participants, but at far lower levels than those seen in the ill Class. Hydrocortisone in medically healthy tissues can promote controlled chemotaxis, which is crucial for immune modulation, possibly because bacteria in a healthy oral cavity can induce a low-grade inflammatory response in periodontic tissues.

Significant correlations were seen between PI and BOP throughout all Class levels, indicating that greater SCL is associated with periodontal damage.

5. Conclusion

Within the parameters of the study, hydrocortisone was associated with both CP and psychological distress. In patients with both CP and anxiety, the levels of these proteins are elevated. Hydrocortisone levels in saliva increase with both inflammation and anxiety.

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