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Salivary Cortisol Response to Different Dental Treatments in Kermanian Patients

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The physiological stress of different dental procedures (dental examination, dental prophylaxis, endodontics, restoration and tooth extraction) were determined in 62 healthy, non-smoking, non-pregnant kermanian patients with normal sleep pattern, age between 18 and 55 years (mean 32) with a salivary cortisol assay using radioimmunoassay technique. Expecterated saliva was collected at 4 time points: 10 min before the start of the procedure (stage A), 10 min after the patient was seated (stage B), at the end of the procedure (stage C) and 15 min after the completion of the procedure (stage D). Mean cortisol value for 248 samples at four different time points ranged between 12.62 to 24.56 nmol L⁻¹. The differences among the mean cortisol levels within each treatment group, was not significant but they were apparent. Only in the restoration group, the mean cortisol level during treatment was increased in comparison to stage A (20.51±10.88 vs. 16.02±9.46 nmol L⁻¹). [During stage B, in restorative group the mean cortisol level was significantly higher than that of the Endodontics (22.25±12.17 vs. 12.62±6.66 nmol L⁻¹, p<0.006). After the completion of therapy the cortisol level in examination group was higher than the prophylaxis (21.76±6.32 vs. 13.86±8.81 nmol L⁻¹ p<0.015). These data suggest that the adrenal response associated with restorative procedures was higher than the other dental procedures in Kerman.

Key words : Saliva, cortisol, dental treatments

INTRODUCTION

Cortisol is a steroid hormone made in the adrenal glands, which regulates carbohydrate, protein, fat and water metabolism. Its important functions in the body include role in the regulation of blood pressure, cardiovascular function and affects the human stress response^[1].

Cortisol secretion increases in response to any stress in the body either physical or psychological. Whereas decreased output of cortisol results from negative feedback. The more common form of adrenal insufficiency results from chronic administration of exogenous corticosteroids, which disrupts the hypothalamic-pituitary adrenal axis. Inhibition of adrenocortrophic hormone (ACTH) and subsequent decreased level of cortisol can lead to serious changes in homeostasis of the body when stressful conditions happen^[2]. Patients demonstrate a physiologic stress response during dental checkups and treatment^[3]. However the amount of stress generated by variety of dental procedures is not well known.

Changes in adrenaline or nor adrenaline concentration in the urine and serum after dental drilling and filling or extraction had been reported^[4]. It has also been reported that people having oral surgery produced a significant amount of steroids compared with those of healthy patients not receiving any dental treatments. However no statistically significant increase before or during the procedure were found^[5]. Since it have been shown that there is a direct relationship between serum and saliva level of cortisol, the saliva cortisol have been used as an index of stress^[6]. A few studies have measured physiological stress during dental procedure. Miller *et al.*^[7] have shown that the saliva cortisol decreased from the initial levels to the end of procedures by about 15% of patient undergoing three different treatments. They also showed that adrenal stress response associated with tooth extraction is greater than that of associated with the other routine dental procedures.

We examined the level of stress under different dental procedures (endodontics, prophylaxis, examination, extraction or restoration) by measuring the level of salivary cortisol. This research could help prevention of critical conditions for susceptible patients especially those having steroids for a long period.

MATERIALS AND METHODS

Sixty-five non-smoking healthy men (40%) and non-pregnant female (60%) aged between 18 to 55 years, referred to dental school out patient clinic, took part in

this study. Each patient received one of five dental treatments as follows:

Examination: Including soft and hard tissues examination.

Prophylaxis: Including scaling and polishing of teeth without local anesthesia.

Restoration: Involving administration of local anesthesia, placement of rubber dam, excavation of decay with rotary hand pieces and placement of restoratives materials.

Endodontics: Performance of any phase of Root canal therapy using local anesthesia.

Extraction: Including routine extraction of one to three permanent teeth with local anesthesia.

Local anesthesia used was 2% lidocaine-HCl with 1: 80000 epinephrines. The procedure started at 9 to 9:30 each morning and took less than 2 h. Saliva samples (1-2 mL) were taken at 4 different intervals: A) 10 min before the start of the procedure; B) 10 min after the patient was seated; C) At the end of the procedure and D) 15 min after completion of the procedure.

The subject's mouth was rinsed with 25 mL tap water before collection of samples. Salivary samples were kept cool then centrifuged at 10000g for 5 min. The supernatant was collected and used for cortisol determination. Radioimmunoassay kit of Orion Diagnostic (Finland) was used for cortisol assay. Statistical analysis performed using SPSS, version 10.

RESULTS

The cortisol concentrations of 65 patients undergoing various dental procedures (Total of 248 samples) were determined. No significant difference was found between cortisol values of male or female ($p \leq 0.48$). The mean cortisol levels within all treatment groups ranged between 12.62 to 24.56 nmol L⁻¹ (Table 1). The average mean concentration of cortisol at 4 stages for restoration group was 19.37 nmol L⁻¹ extraction 17.08 nmol L⁻¹ examination 21.12 nmol L⁻¹ prophylaxis 18.1 nmol L⁻¹ and for endodontics 14.35 nmol L⁻¹.

The changes in cortisol levels were similar for examination, prophylaxis and endodontics in all stages were decreasing compared to the stage A. The mean cortisol values 10 min after the patient was seated (stage B) decreased 21.9% in examination 26.3% in prophylaxis and 17.95% in endodontics groups. The level

Table 1: Mean±SD of cortisol levels for different treatments at four different time points

Stages	Endodontics	Prophylaxis	Examination	Extraction	Restoration	Sum
A	15.38±5.45	24.56±17.59	23.91±7.87	17.41±17.64	16.00±9.46	19.75±12.28
B	12.62±6.66	18.10±7.65	18.66±7.94	14.92±5.94	22.25±12.17	17.21±8.67
C	15.08±5.97	13.86±8.18	21.76±6.32	16.38±10.02	20.41±10.44	17.53±8.62
D	14.34±8.18	15.91±9.10	20.15±8.96	19.61±13.07	18.84±10.05	17.77±9.96

of cortisol at stage C compared to stage A in prophylaxis group 43.5% diagnostics 9% and in endodontics 2% were decreased (Table 1). The changes between four different stages in each treatment group were not statistically significant. But it was significant between all stages for the sum of the treatment groups.

Based on the statistical analysis, a regression line for predicting the cortisol level at stage C had been found: Cortisol at stage C (nmol L⁻¹) = (Cortisol level at stage B × 0.575) + 7.5

DISCUSSION

Stress response under five types of dental treatment (restoration, extraction, examination, prophylaxis and endodontics) was examined.

Although the saliva cortisol makes up about 50 to 60% of the free cortisol in the plasma^[7] many reports have been shown that salivary cortisol is an accurate measure of adrenocortical function^[6]. The advantage of the saliva is the ease of collection and is a noninvasive manner. Because of its low concentration in saliva, it must be determined by a sensitive method such as RIA.

Our data showed that no significant differences were found in cortisol values between stages (A, B, C and D) in either procedures, perhaps due to small size of the samples or really due to lack of any changes in the cortisol values under these conditions. In patients undergoing endodontics the highest decrease in cortisol level was observed at stage B that was in accordance with those of Morse *et al.*^[8] and Miller *et al.*^[7]. Under this procedure during stage, C and D the level of cortisol slightly increased compared to stage B, which could be due to its long lasting step.

In prophylaxis, the mean cortisol value at the start of the procedure compare to the other stages was the highest, which continuously decrease during the procedure. This was in contrast with that results found by Miller *et al.*^[7].

During extraction and after administration of local anesthesia (Stage B) the cortisol level had been reduced but it was elevated after the end of the procedure (Stage D). These phenomena could be explained by mixing the saliva with the blood at the end of the extraction. Although the reduction of cortisol at stage C was not in accordance with that of Miller *et al.*^[7] who showed a remarkable increase in cortisol level at stage C.

In restoration procedure the mean cortisol concentration in all stages were increased compared to basal level of stage A, which was in contrast to that of Miller *et al.*^[7]. An explanation for this elevation in our patients might be the length of the procedure, which performed by the dental student in this study, because lengthy operation has been shown to be associated with elevated corticosteroid levels^[9]. It is difficult to compare these data with those of other investigators because of technical, psychological, environmental and availability of facilities, which might have affect on the patients.

In summary these data may suggest that the adrenal response associated with restorative procedures was higher than the other dental procedure in Kerman.

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