ORIGINAL ARTICLE

A comparative analysis of the level of cortisol and the number of teeth extracted among patients undergoing routine dental extraction

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Abstract

Background and Objective: A postextraction comparative (cohort) study was carried out to determine whether the number of teeth extracted has an effect on salivary cortisol and by extension on stress.

Subjects and Methods: Sixty-three consecutive patients comprising 27 males (42.9%) and 36 females (57.1%) with a male: female ratio of 1:1.3, divided into two groups of A and B with a mean age of 25.8 ± 4.9 years, and age range of 18–37 years took part in the study. Fifty (79.4%) of them in group A (22 males and 28 females) each had a tooth extracted while 13 (20.6%) in group B (5 males and 8 females) had two teeth removed. One ml of resting saliva was collected from each patient 10 minutes after the procedure and analyzed for cortisol. All extractions and sample collections were done between 10 am and 2 pm to standardize the study and control for the diurnal variation of cortisol. Statistical analysis of the generated data was performed by using Student's *t*-test on SPSS version 17.0. The level of significance was set at 0.05 with $P < 0.05$ regarded significant.

Result: The result showed mean salivary cortisol level of 12.914 ± 2.4684 ng/ml for group A and 12.108 ± 1.7192 ng/ml for group B though not statistically significant ($P > 0.05$). Females had more extractions in the two groups when compared with males. Male gender had a statistical significance difference ($P < 0.05$).

Conclusion: This study shows that the number of teeth extracted did not have effect on mean salivary cortisol, as a result two teeth extraction does not impart more stress to the patient when compared with one, and as such no additional adjuvant stress relieving measures are needed in two teeth extractions.

Key words: Extraction, number of teeth, salivary cortisol, stress

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Introduction

Dental patients undergo varying degrees of stress during procedures; these are evidenced by the changes in salivary cortisol level.[1,2] Salivary cortisol reflects the physiologically unbound active fraction of blood cortisol, which exerts biological activity.[3-5] Cortisol, known as the stress hormone is employed as an indicator of stress in stress evaluation studies.[1,2,6] However, there are some other less utilized methods of evaluating stress, which include the effect of stressors on circulating white blood cells and other blood parameters,[7] salivary amylase activity,[8] and interleukin 1 β.[9]

A dental extraction is carried out routinely and has been adjudged to be stress producing.[1,10,11] The degree of surgical stress directly correlates with cortisol elevation.[12]

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This study was to ascertain whether the number of teeth extracted has an effect on salivary cortisol level and by extension on stress.

Subjects and Methods

This study was an analytic (cohort) study where the outcome of interest was the salivary cortisol level in relation to the number of teeth extracted among two groups of patients undergoing routine dental extraction. Sixty-three subjects participated in the study and were divided into two groups. Group A had single tooth extraction each while group B had two teeth extracted. They were consecutive male and female patients scheduled for simple intraalveolar extraction of one or more teeth and aged between 18 and 37 years, and who consented to participate in the study. Approval for the study was obtained from the Health Research Ethics Committee of the Institution and patients also gave due consent before being recruited into the study.

Excluded from the study were patients on steroid medication, oral contraceptives, those on drugs that caused hyposecretion of saliva such as atropine, calcium channel blockers, antidepressants, and antihistamines. Furthermore, excluded were pregnant women, patients with systemic conditions contra indicating dental extraction such as bleeding diathesis, uncontrolled diabetes mellitus, and uncontrolled hypertension and those with pathologies that decreased saliva secretion or altered its character such as Sjögren's syndrome and radiation therapy. Highly dentally anxious patients with scores higher than 19 cut off point in the Humphris Modified Dental Anxiety Scale,[13] were also excluded.

All the extractions were done by one of the investigators using forceps and elevators after the administration of 2% lidocaine in 1:100,000 adrenaline. This was followed by the collection of 1 ml of unstimulated saliva from each patient 10 minutes after extraction using disposable micropipette and polypropylene vial. Any sample with the slightest tinge of blood contamination by visual examination was discarded. All extractions and sample collection were done between 10 am and 2 pm each day to standardize the study and also control for the diurnal variation of cortisol. The saliva samples were frozen in the refrigerator pending cortisol analysis. The laboratory analysis was done using a custom designed salivary cortisol kit manufactured by DRG Instrument GmbH, Germany, Frauenbergstraβe 18, D-35039 Marburg.

Statistical analysis of the generated data was performed using Student's *t*-test on SPSS (version 17.0 SPSS Inc., Chicago, IL, USA). The level of significance was set at 0.05 with $P < 0.05$ regarded as being significant.

Result

Sixty-three subjects with an age range 18–37 years and mean age 25.75 ± 4.91 years were recruited. Twenty-seven of them males (42.9%) and 36 females (57.1%) giving a male: female ratio of 1:1.3. Their saliva samples were analyzed for cortisol level following teeth extractions. The mean saliva cortisol level postoperatively was 12.75 ng/ml.

Fifty (79.4%) single tooth (22 males and 28 females) and 13 (20.6%) two teeth extractions (5 males and 8 females) were carried out. The sociodemographic characteristics of the respondents are as shown in Table 1. Age distribution and sex of the respondents are in Table 2. Female had more number of teeth extracted compared with the males in both groups.

Comparison of the postextraction mean salivary cortisol levels between single and two teeth extraction groups showed a value of 12.914 ± 2.4684 ng/ml for single tooth extraction group and 12.108 ± 1.7192 ng/ml for two teeth

Table 1: Sociodemographic characteristics of respondents

Number of teeth extracted	Frequency	Percentage
Single tooth extraction	50	
Maxillary teeth	20	79.4
Mandibular teeth	30	
Two teeth extraction	13	
Maxillary teeth	13	20.6
Mandibular teeth	13	
Sex		
Males	27	
Group A	22	42.9
Group B	5	
Females	36	
Group A	28	57.1
Group B	8	
Occupation		
Students	41	65.1
Businessmen/women	4	6.4
Civil servants	11	17.5
Youth Corp members	4	6.4
Self-employed/artisan	2	3.2
Security man	1	1.6

Table 2: Age distribution and sex of the respondents

Age range	Single tooth		Two teeth	
	Male	Female	Male	Female
18-22	4	11	1	4
23-27	12	11	-	2
28-32	4	2	2	1
33-37	2	4	2	1
Total	22	28	5	8

Table 3: Comparison of postextraction mean salivary cortisol levels between single and two teeth extractions

Extractions	Number of participants	Mean (ng/ml)	SD	Mean difference (ng/ml)	*P*
Single tooth extraction	*n*=50	12.914	2.4684	0.8060	0.27
Two teeth extraction	*n*=13	12.108	1.7192		

SD=Standard deviation

Table 4: Comparison of postextraction mean salivary cortisol levels between single and two teeth extractions in male participants

Extractions	Number of participants	Mean (ng/ml)	SD	Mean difference (ng/ml)	*P*
Single tooth extraction	*n*=22	12.9682	2.7120	1.5082	0.04
Two teeth extraction	*n*=5	11.46	0.7473		

SD=Standard deviation

Table 5: Comparison of postextraction mean salivary cortisol levels between single and two teeth extractions in female participants

Extractions	Number of participants	Mean (ng/ml)	SD	Mean difference (ng/ml)	*P*
Single tooth extraction	*n*=28	12.8714	2.2091	0.3589	0.68
Two teeth extraction	*n*=8	12.5125	1.9127		

SD=Standard deviation

extraction group with a mean difference of 0.8063 ng/ml and a $P = 0.27$, which was not statistically significant as shown in Table 3. Table 4 shows a comparison of the postextraction mean salivary cortisol levels between single and two teeth extractions in male participants with $P = 0.04$, which was statistically significant. On the other hand, there was no statistical significant difference ($P = 0.68$) in females when the mean salivary cortisol between single and two teeth extraction groups following extraction were compared [Table 5].

Discussion

This study was designed to ascertain if the number of teeth extracted has effect on cortisol level, with regard to the stress imparted by such procedures. There is a relative paucity of studies that examined whether routine dental treatment has an effect on cortisol.[1,14] The literature search did not show previous studies relating the number of teeth extracted to the cortisol level. Studies have shown that routine dental extraction causes changes in cortisol level.[1,2,10] Whereas some authors suggest that changes are insignificant and similar to that caused by a minor surgical procedure,[2,14,15] others have reported significant changes in cortisol level following routine dental extraction.[10,16] Cortisol level closely mirrors the stress the individual is undergoing.[6]

However, our study showed there was no significant difference between the two groups studied. This is in agreement with the assertion of Banks[15] that during minor oral surgery procedures lasting <1 h, plasma cortisol shows a minimal increase. Furthermore, there is a direct correlation between the degree of surgical stress and elevation of cortisol with minor procedures like dental extraction causing minimal increase while major surgeries induce a marked elevation.[12]

From this study, it could be inferred that the number of teeth extracted did not have a significant effect on the salivary cortisol level and by implication on the stress imparted to the patients. This suggests that the degree of stress experienced by an individual had no bearing on whether one or two teeth were extracted. However, the non-significance could be attributed to fact that the difficulty encountered in some of the two teeth extractions could have been less than that for some single teeth, as there was no yardstick to measure level of difficulty in this study. Perhaps, it may be pertinent to carry out further studies on the role of the difficulty of the extraction and its relationship to cortisol level changes.

This study utilized a small group of consecutive patients; however a larger study with careful recruitment of patients requiring more number of extractions per treatment session, taking into account the difficulty of extraction is needed to determine conclusively, the absolute relationship between number of teeth extracted and cortisol level.

Regarding sex and the level of cortisol on single and two teeth extraction, there was no statistical significant difference among the female participants ($P = 0.68$) while for the males [Table 4] there was statistical significant difference ($P = 0.04$). This means the number of teeth extracted in the male group affects the level of cortisol. This might be explained in terms of the mean variance being higher than expected because of the much lower number of males (5) who underwent two teeth extraction as against 22 males for single extraction. It appears that this study is a novel research as we do not know any other such study, especially in our environment. However, this could elicit further studies in this area.

The females in this study had more number of extractions than their male counterparts in the two groups. This is in agreement with previous reports that ascribed it to the fact that women use more health care facilities than men.[17,18] It could also be as a result of biological composition and flow rate of saliva, hormonal fluctuation, dietary habit, and longer exposure to the cariogenic oral environment, which predisposes females more to caries than their male counterparts.[19,20]

Conclusion

This paper has shown that by comparing one tooth with two teeth extractions, there was no significant effect on

mean cortisol level and by extension the stress imparted on patients. As such, no additional adjuvant stress relieving treatments are required in two teeth extractions.

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