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Dental Fear in Children with Cleft Lip and Palate and their Correlation to Salivary Cortisol Levels

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Abstract: ***Aim:*** *To assess the level of dental fear in children with cleft lip and palate, to compare it with that of a normal group and to correlate the level of fear with the salivary cortisol levels in both the groups.* ***Materials and Methods:*** *This study was conducted on 60 children of age group 4-10 years selected from Mahaveer Jain Hospital, Bangalore. 30 children in the study group were children with cleft lip and palate and 30 normal children age and sex matched, visiting the dental wing of the same hospital for routine dental procedures were selected as the control group. On arrival to the clinic the children were asked to rinse mouth and pre-treatment salivary samples are collected. The Children's Fear Survey Schedule Dental Subscale (CFSS-DS) was selected for the study to psychometrically analyze the fear status of the children consisting of 15 questions, related to various aspects of dental treatment. The children were then subjected to a stressor to measure rise in cortisol levels, in the post stress application period. After impression making the post treatment salivary sample were collected. This procedure was carried out similarly for the study and the control group. Assessment of the fear levels were correlated with the difference in salivary cortisol levels (whether it is high, low or same) in both the groups. The difference in salivary cortisol levels both pre and post treatment are also compared between both the groups. Then comparative assessments of both the groups were made.* ***Results:*** *The present study showed that the fear survey conducted using the child's fear survey schedule dental subscale among the children showed that only 11.7%were very much fearful about the procedure. 62% of the population in the control group shows a not fearful group, 23% of the control group shows a moderately fearful group and 12% of the group represents a fearful population. The mean values of the CPSS scores in the study group was 27.57 and that of the normal group was 25.73. The mean values of the CFSS scores was almost similar in both the groups and the difference between the two means were statistically insignificant with p = 0.18 obtained using independent t test. The fear scores of the two groups were in the same range indicating same psychometric scores for both the groups. The mean values of the cortisol values pre and post treatments showed decimal changes with no significant value rise between the pre and post values. The mean value of preoperative cortisol values in the study group is 0.165 plus/minus 0.12 and that in the normal group is 0.191 plus/minus 0.07 difference in these values is not very high indicating the pre-treatment cortisol levels do not show a statistically significant difference between the two groups (p = 0.343) . The mean value of preoperative cortisol values in the study group is 0.2377 plus/minus 0.26 and that in the normal group is 0.201 plus/minus 0.22 The difference in these values is not very high indicating the pre-treatment cortisol levels do not show a statistically significant difference between the two groups(p-0.56). The difference between the two groups in age fear scores, pre and post cortisol values was calculated using the paired t test. Unpaired t test was used to calculate the difference in mean score between groups. On analysis for the pre operational cortisol values between the two groups do not show any statistical difference between the study and the control groups (p value 0.3). The post operational cortisol values between the two groups do not show any statistical difference between the study and the control groups (p value-0.5). The mean values of the normal group was found to be 0.2010+21786 and that of the CLP group was found to be 0.237725974. Pearson correlation used to calculate correlation of cortisol level and CFSS score. Present study shows that there was a weak negative correlation between cortisol pre-operative level and CFSS score (-0.118) and this was statistically insignificant at 5% significance level (p=0.368) and there was a weak positive correlation between cortisol post-operative level and CFSS score (r=0.151) and this was statistically insignificant at 5% significance level (p=0.250).* ***Conclusion:*** *The results of the study concluded that the fear ratings showed a comparatively not fearful group of children both in the study and the control group. The study group showed fear scale similar to that of the control group concluding that the CLP children did not show an increased response of fear. In the study group there was no considerable rise either in the preoperative or post-operative samples which showed that the previous experiences in hospitals and various treatments did not have a potentially high negative influence on them but infact could make them desensitized to the anxiety provoking stimulus in the dental operatory and could gear them to bear more of such situations like normal people or even better. The post-operative values comparatively higher in the study group showed that this group of children also had procedural anxiety rather than a preoperational anxiety which could probably indicate any influence of the previous experiences. In the present study the psychometric results matched the biometric parameters reassuring its validity and reliability.*

Keywords: Cleft lip and palate, Dental fear, Stress, CFSS-DS, Salivary cortisol

1. Introduction

Dental fear and anxiety is recognised as a severe problem in patient management for pedodontist, child and the parent making the delivery of the dental treatment very challenging. Fear is defined as the unpleasant emotional state consisting of psychological responses to a real external threat or danger which includes agitation, alertness, tension, mobilization of the alarmed reaction. They are also likely to experience other behavioural and emotional problems which lead to reduction in overall health and wellbeing and children with orofacial clefts are no exception.[1]

Cleft lip and palate is one of the most common deformities affecting the orofacial region. It occurs with a prevalence as common as one in every 500-750 live births on an average. Children with cleft lip and palate undergo a number of rehabilitation procedures making them vulnerable to psychological problems throughout their life time both during medical and dental procedures associated with them and also due to the social stigma associated with them. This section of pediatric population needs to be dealt with utmost (TLC) Tender love and care as they are subjected to multiple admission surgeries, resurgeries, traumatic experiences in the hospital environment with even post traumatic stress de due to multidisciplinary faculties handling child. The growing child faces lots of fear of stranger, fear of unknown including doctors and hospital setups

The parents are burdened physically, emotionally and fundamentally so this effects the normal growth of the child and neglect of the child leading to fear and anxiety[2].

Aim

To assess the level of dental fear in children with cleft lip and palate, to compare it with that of a normal group and to correlate the level of fear with the salivary cortisol levels in both the groups

2. Methods

Participants

Thirty subjects with cleft lip and palate aged 4-10 years were selected from Cleft centre, Permission to examine, conduct study and collect data from patients with cleft lip and palate were obtained by concerned authorities and purents or legal guardians.

Children with CL/P group

Thirty subjects with cleft lip and/palate in the age group of 4-10 years reporting for recall visits with previous history of any oral rehabilitation procedures, in the afternoon before having their meal so as to avoid meal induced hike in cortisol levels and to avoid diurnal variation in cortisol level

Controls

Normal children without cleft lip and palate of age group 6 to 12yrs reporting for routine dental treatment who have come for follow up in the afternoon without the history of any systemic diseases, pus discharging lung diseases like bronchitis which can contaminate salivary secretions two weeks prior to saliva collection, without salivary gland dysfunction

Salivary cortisol level

Collection of saliva

All participants of both the group received oral instruction in saliva sampling when the child was visiting the dental clinic with their parent .On arrival to the clinic the children were asked to rinse mouth and pre-treatment salivary samples are collected by passively spitting into the 10 ml saliva collection bottles. The salivary samples collected was unstimulated saliva.

Pre- operative samples are collected from both the groups

All children were then subjected to oral examination using mouth mirror and probe. In this study the patients were subjected to impression making as a stressor. Post impression salivary samples were collected similarly and analyzed for difference in the unbound salivary cortisol

Impression making procedure used as a stressor in both the groups

After collection the samples were kept cold in order to avoid bacterial growth in the specimen. Then the samples were centrifuged at 3000 rpm for 15 minutes and the supernatant was transferred to another container. These centrifuged samples were then stored below -20°C. The supernatant samples in a tight container (approximately 10 ml) was then packed in 2-3 cold ice packs and then was transported to the laboratory for cortisol analysis.


Post operative salivary samples are collected after the impression making is done in the study group

3. Analysis

The Salivary Cortisol Estimation was done by the newer quantitative ElectroChemiluminescent Immunoassay (ECLIA) method. Assessment of the fear levels were correlated with the difference in salivary cortisol levels (whether it is high, low or same) in both the groups. Comparative assessments of both the groups were made.

The Children's Fear Survey Schedule Dental Subscale
The Children's Fear Survey Schedule Dental Subscale (CFSS-DS) was the fear scale selected for the study to psychometrically analyze the fear status of the children. CFSS-DS presented by Cuthbert and Malamed is one psychometric method that is widely used in pediatric dentistry. It has construct validity and psychometric properties. CFSS-DS consists of 15 items, related to various aspects of dental treatment. Each item can be scored on a 5 point scale from 1(not afraid) to 5(very afraid). Total scores ranges from 15 to 75. The classification of scores is as following:

Below 32 -not anxious
32-39 -potentially anxious
Above 39 -very anxious

The CFSS is a frequently used questionnaire to assess dental anxiety, with sufficient construct validity and psychometric properties. The internal consistency of the Dutch version appeared to be high. The parents were also asked to assist the children as the parents are well able to assess the child's dental fear. Given that only a very weak correlation exists between child dental anxiety and parental dental anxiety, the method is generally accepted to assess child dental anxiety in toddlers and pre-schoolers. All participants were asked to fill out the questionnaire.

Distribution of Fear Assessment Questionnaire
All children were then subjected to oral examination using mouth mirror and probe. The children were then subjected to a stressor to measure rise in cortisol levels, in the post stress application period. Psychological stressors are stimuli that affect emotion and result in fear or frustration and are among the most potent activators of the hypothalamus pituitary axis leading to cortisol secretion.

Statistics
The data was collected and entered into Microsoft excel spreadsheet and analyzed using Statistical Package for Social Sciences (SPSS) version 20 (SPSS Inc. California, USA). Descriptive Data were presented in the form of frequencies, percentages, mean and standard deviation

Inclusion of participants
In course of the study a total of 60 people were recruited 30 each from a group of children with cleft lip and palate and 30 people from the normal group. 28(46%) out of the total children in the study comprised of females and 32 (53.3%) comprised of males. The mean age group included in the study was around 7 years and the age groups varied within an upper limit value of 9.0 and lower limit value of 5.7.

Children with CL/P
Thirty subjects with cleft lip and/palate in the age group of 4-10 years reporting for recall visits with previous history of any oral rehabilitation procedures, in the afternoon before having their meal so as to avoid meal induced hike in cortisol levels and to avoid diurnal variation in cortisol level

Controls
Thirty normal children without cleft lip and palate of age group 6 to 12yrs reporting for routine dental treatment who have come for follow up in the after noon

Exclusion of Participants

Children with CL/P
Subjects with lack of communication skills, who are mentally challenged ,having history of pus discharging lung diseases like bronchitis which can contaminate salivary secretions two weeks prior to saliva collection, having history of any medication which influences salivary cortisol levels two weeks prior to saliva collection, individuals with salivary gland dysfunction, with drug or alcohol abuse problems or prescribed medication intake ,having history of any psychological problems were excluded from the study.

Controls
Subjects with history of any systemic diseases ,history of pus discharging lung diseases like bronchitis which can contaminate salivary secretions two weeks prior to saliva collection ,individuals with salivary gland dysfunction, Subjects with history of any medications for the past two weeks specially corticosteroids were excluded from the study.

4. Results

Concentration of salivary cortisol

The pre- operative cortisol value ranges from 0 to 0.46 which is in the normal range of cortisol in an individual which comes under the inclusion criteria of the present study.

The post-operative cortisol values comes in a range of 0 to 1.10 µg/dl which is also of a normal range, there is no significant rise in the cortisol levels due to an increase in stress levels. The post-operative cortisol levels in the control group showed insignificant difference from that of the study group and also with that of the preoperative values. The mean value of pre-operative cortisol values in the study group is 0.165 plus/minus 0.12 and that in the normal group is 0.191 plus/minus 0.07. The difference in these values is not very high indicating the pre-treatment cortisol levels do not show a statistically significant difference between the two groups ($p = 0.343$). The mean value of preoperative cortisol values in the study group is 0.2377 plus/minus 0.26 and that in the normal group is 0.201 plus/minus 0.22 The difference in these values is not very high indicating the pre-treatment cortisol levels do not show a statistically significant difference between the two groups $p = 0.56$)

CFSS Scale

The CFSS score distribution in the general population was calculated considering both the groups. The mean of the total fear scores of both the groups together was calculated to obtain the frequency distribution chart

The CFSS scores ranged between values of 13 and 57. A greater number of the values are centered around values between 17 and 34 which showed that the highest percentage of the population showed a not fearful group. The maximum number of the patients in the 61% of the population which constituted the not fearful group scored values in this range. The results showed that the values of the CFSS scores was centered to a maximum in the not fearful scoring range (GRAPH 5). 59% of the population in the study group shows a not fearful group, 23% of the study group shows moderately fearful group and 12% of the group represents a fearful population . 62% of the population in the control group shows a not fearful group, 23% the control group shows a moderately fearful group and 12% of the group represents fearful population (GRAPH 7). The mean values of the CFSS scores in the study up was 27.57 and that of the normal group was 25.73. The mean values of the CFSS was almost similar in both the groups and the difference between the two means statistically insignificant with $p = 0.727$ obtained using independent t test. The scores of the two groups were in the same range indicating same psychometric for both the groups (GRAPH 8).

Table 5 shows the correlation between the two groups using the chi square test showed there is no significant difference between the CFSS scores in either of the groups. Both the groups showed similar values while the fear scale was scored There was no statistically significant difference between the score values of the two groups (p value = 0.727). The mean values of the cortisol values pre and post treatments showed decimal changes with no significant value rise between the pre and post values in the pre and post treatment samples. 95% confidence values showed a mean range of 0.23 with a standard deviation of 0.2. A normal range of cortisol level of 0.4 µg/dl of saliva indicated that the standard deviation did not show a significant variation with the regression analysis in a sample size of 30. When the normal range is taken as standard the real values obtained does not show a significant rise either in the post or pre-treatment values. Though not significant the comparative value showed a marginal reduction in the post treatment values which showed that the stress was comparatively less during the post treatment phase when compared to that of the pre-treatment on an average in both the groups (Table 6).

Correlation between concentration of salivary cortisol and dental fear

Pearson correlation was used to calculate correlation of cortisol level and CFSS score. Present study shows that there was a weak negative correlation between cortisol pre-operative level and CFSS score ($r=-0.118$) and this was statistically insignificant at 5% significance level ($p=0.368$) and there was a weak positive correlation between cortisol post-operative level and CFSS score ($r=0.151$) and this was statistically insignificant at 5% significance level ($p=0.250$) (Table 8)

5. Discussion

The quality of life of children with CLP is influenced negatively by medical overexposure starting at birth (Prahl, 2008). Children with CLP are exposed to invasive medical procedures right from the first year of life. In order to repair the defects and to treat functional problems several procedures So a major hurdle which comes along while delivering the treatment modalities to this sector of special patients is the dental fear and anxiety of the children. Hence a proper understanding of the cause of such fears play an important role in planning the treatment protocol for such children. Litt reviewed the effects of anxiety on pain perception, and argued that in clinical situations of acute pain, anxiety and pain may be indistinguishable[4]. Fear not only lowers the pain threshold, but actually leads to the perception of painless stimuli as painful. so fear becomes a very crucial element in the management of cleft patients here.

The study was conducted with an aim to asses dental fear in CLP patients with that of their normal counterparts using psychometric scale and using a biometric scale using salivary cortisol levels which acted as biologic marker for stress. The current explorative study and examining fear and anxiety in children with cleft of the orofacial region[5]. The study evaluated and compared the extensity of dental fear in cleft lip and palate children with their normal counterparts within an age group of 4 to 10 yrs to asses if they are more vulnerable to fear and its related risk factors

An age group of 4 to 10 years was chosen because studies have shown that children in 7 to 10 years age group exhibited greater dental fear than 11 to 14 years age group." Lee et al found that younger children express higher dental fear, but different from reports by Arapostathis et al where mean scores were not related to age differences[6]. In a study done by Salem et al they concluded that the age group of 3-4 years old children in their study showed the lowest prevalence of dental

fear and anxiety. This finding may be attributed to lack of cognitive maturity, because the children have no clear perception of real fear at this age .In 7 to 14 year olds, the ability to comply with the dental treatment increases with age[7].

A study by Emmanuel nicolas et al showed that Dental anxiety often originates in childhood (51%) and cleft patients are subjected to continuous dental appointments since birth needless to say.

the present study tried to assess the fear of the child reporting the line with help of a psychometric scale. We chose Dental subscale of Children's Far Survey Schedule (CCESS-DS) for the psychometric measurement which is used extensively due to its reliability and validity

The CFSS-DS was initially presented by Cuthbert and Melamed. It is considered to work well on a group basis rather than on individual level. Comparing properties of different self-report measures, Artman et al concluded that CFSS-DS was preferred as it has better psychometric properties, measures dental fear more precisely, covers more aspects of the dental situation, and since normative values are available and studies showing high test-retest reliability for the CFSS-DS[20]. Dogan et used both the Facial Image Scale scale and CFSS Scale to assess fear in CLP patients, and reported that though Facial Image Scale is very easy and can be completed in 3 minutes but more validity and reliability was reported for CFSS Scale. The CFSS scale helps in figuring out a general anxiety trait when compared to that of Facial Image Scale or Venhams Picture Test[22].

We assessed the levels of cortisol to check if it is reliable and valid as much as the psychometric grading so it can be used as a substitute in CLP patients. It can also be used as a biometric marker in the case of stoic patients where psychometric scales fail to elicit good results an children is difficult. Thus, cortisol levels in the saliva was used as a biometric scale to assess the credibility of the psychometric scales and the validity of the results obtained through the psychometric scales[23]. Situations involving pain, anxiety and acute tissue injury increase the activity of the HPA axis which in turn enhances secretion of cortisol[24].

The cortisol levels were checked preoperatively and post operatively to a treatment procedure namely the impression making was done so that foar levels could be biometrically evaluated[26]. There were two findings of particular interest. First, the analysis of saliva samples showed approximately equal cortisol levels at baseline and a similar increase in cortisol concentrations for the CLP and the control group, respectively. The base line cortisol levels in both the normal and cleft lip and palate children showed in the range of 0.15 to 0.26 µg/dl. In the blood only 1 to 15% of cortisol is in its unbound or biologically active form[30]. The remaining cortisol is bound to serum proteins

The unbound serum cortisol enters the saliva via intracellular mechanisms and in saliva the majority of cortisol remains unbound to protein. Salivary cortisol levels are unaffected by salivary flow rate of salivary enzymes Serum and urine cortisol levels is most frequently used as marker in the diagnosis for different kinds of stress-induced reactions, In serum, cortisol is mainly protein-bound and is usually measured as such[32]. The transfer from serum to saliva occurs by free diffusion of unbound cortisol through the acinar cells of the salivary glands and the equilibrium between senam and saliva is reached in les than 5 minutes[35]. The cortisol in saliva being mainly free, implying that the elevation of the salivary cortisol concentration is not due to higher concentrations of transcortin[38].

The salivary samples were collected at the afternoon so as to avoid any diurnal variation of the cortisol levels. Usually they peak at the morning hours which will give a very high value which might be contradicting with the study aim so the study and control groups were subjected to sample collection only in the afternoon times.

In the present study the results of the CFSS scoring showed that 61.7% of the children when both the study and the control group were combined were not fearful. In the study group 10% were fearful and in the control group 13% were fearful when assessed with the psychometric scales which showed that both the normal and the CLP patients showed a higher percentage of not fearful population. On comparing the mean values of the fear scale scores the normal group with that of the study group it was found the values were not statistically significant difference with p= 0.75. This showed that the children belonging to this special group did not have a significantly higher fear when compared to that of the normal group. The results were consistent with the studies done by Dogan et al which showed that the fear scale scores of CLP patients were lower than that of the normal children[40].

A study by Gassling V et al comparing the stress levels in CLP patients and normal showed that there is more or less intensive disturbance of facial appearance and speech impediment which might lead to particular psychosocial stress in affected the individuals. This was in accordance with our present study where again the stress levels are same in both the groups. After stress induction there was a similar increase in cortisol concentrations in both groups. Subsequently, the decline in cortisol concentrations was significantly faster in the CLP group. The results of our study were not in accordance with that of the findings by W.E.J.C. Vogels et al who showed that young children with CLP experience more dental fear compared with children in a normative control group A weak correlation was found between the child's dental anxiety (CFSS-DS) and his or her coping behaviour (Dental Coping Questionnaire) [44]. A clear correlation existed between the scale used to estimate the stress and the CFSS scores of the youngest age group[41]. Their conclusions supported the hypothesis that dental anxiety is related to a higher level of exposure to medical interventions at a young age

Present study shows that there was a weak negative correlation between pre-operative cortisol level and CFSS score (r=-0.118) and this was statistically insignificant at 5% significance level (p=0.368) and there was a weak positive correlation between post-operative cortisol level and CFSS score (r=0.151) and this was statistically insignificant at 5% significance level (p-0.250).

The subscales of the CFSS were evaluated in order to understand the source of fear and anxiety. Although the number of items included in CFSS about the general anxiety is limited (only 3 items), these scores can be used as prior information to the situational fear status of the child. "This study indicates that the anxiety level of CLP children may be related to general anxiety. The values of the cortisol levels were found to be in par with that of the CFSS scale. One reason why the cortisol levels do not show an increased values is may be because the levels of the unbound cortisol in the serum is not raised so high that they can be measured in the saliva.

The results of our present study showed that the fear in CLP patients were not high when compared with that of their normal counterparts

According to the results of this study, CLP children have lower dental fear in the dental chair than do children without CLP as they gain more emotional strength due to these kind of psychological liabilities. This finding supports the idea that children's dental anxiety may decrease with regular exposure to medical intervention.

In a previous study by Furlan NF et al they have fond that salivary cortisol levels are good biomarkers to find the stress during dental procedures. Another study by Pani SC et al showed finding of significantly higher cortisol levels in children with ECC that indicate a higher cortisol levels in children with caries. "In this study also salivary cortisol was used as positive biomarker for stress.

In our study a possible reason why the stress levels do not considerably rise in the study group can be because of the desensitisation which had occurred due to the continuous exposures of the children to a series of medical procedures. The present study showed that the pre-operative cortisol levels were higher in the normal group (mean value 0.191) rather than the study group (mean value = 0.1653). The psychometric evaluation scales showed that the fear of the children in both the study group and in the control group was highest for injections among all the 15 questions in the CFSS-DS questionnaire.

The present study showed no considerable decrease or increase of fear in the cleft group when compared with that of the normal group of children

The psychometric scale focused on a general anxiety of the child rather than a state anxiety have given a possible deviation to the fear scores to a more generalised aspect of fear rather than fear acquired through past experiences or any such reasons which could build up a state anxiety. The normal values of the biometric variable used in the study was very low and any rise in it was too insignificant to have produced a positive

Though no statistically significant high levels for fear are obtained for children CLP a post treatment hike in the cortisol levels calls for a better behaviour management strategy in these special group children so that their future appointments are made less stressful.

6. Conclusion

Within the limitations of the study the following conditions can be drawn:

- The previous experiences in hospitals and various treatments undergone could make them desensitized to the anxiety provoking stimulus in the dental operatory or even the graded exposure, in which the subject is exposed to a graded series of anxiety-provoking situation, which is of a higher grade can gear them to bear more of such situations like normal people or even better.
- The psychometric assessment of the study sample showed a comparatively non fearful group of children
- The psychometric results matched the biometric parameters reassuring its validity and reliability.
- Although, the studies on correlation between saliva cortisol concentrations and free levels of this hormone in blood samples are lacking, the study showed that the free unbound cortisol in the blood could be too insignificant to get transferred to the saliva. Sufficient time period would not have been enough for the serum cortisol levels to get transferred to the saliva also would be another possible reason why there is no significant rise in the salivary cortisol levels
- Small sample size may be one of the reasons why no significant differences were found between the groups. Similar study needs to be repeated with a larger sample size.

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