Effect of Dental Treatment on Parental Stress as Measured by the Parenting Stress Index

THESIS

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Abstract

Purpose: The purpose of this study was to determine whether full-mouth rehabilitation of children with severe early childhood caries (S-ECC) had any impact on parental stress as measured by the Parenting Stress Index (PSI).

Methods: This IRB-approved longitudinal case control study consisted of a cohort examined at the Nationwide Children's Hospital Dental Surgery Center (DSC). Children were required to have a minimum of 6 carious teeth for inclusion. Patients were treated under general anesthesia for S-ECC. The primary caregiver completed the PSI and demographic information. Patients were scheduled for a recall visit 1-3 months later with standardized study personnel. Caregivers re-accomplished the PSI. Continuous variables were analyzed using the Student's t-test.

Results: Forty parent-child dyads completed the initial and 3 month recall visits for pilot data. Mean age of children was 43 months (±12.5). Mean caregiver age was 27.4 years (±8.3). Children presented with a mean of 9.6 carious teeth ((±3.4). Treatment of S-ECC did not significantly impact parental stress ($p=0.426$) or total family stress ($p=.237$). There were small but significant changes in three subscales within the Child Domain: Adaptability ($p=0.034$), Reinforces Parent ($p=0.039$), and Mood ($p=0.038$).

Conclusions: Parental stress levels, as measured by the PSI, are not significantly altered by treatment of S-ECC under general anesthesia.

Dedication

This document is dedicated in memory of Kyle Byford.

Acknowledgments

Thank you to my wife, Beth, who has been very patient with me as I neglected many other responsibilities while completing the thesis. Thank you to my committee who has been an incredible source of knowledge and guidance. Thank you to the staff who have helped me with recruitment, data collection, and follow-up, especially Jessica Kull and Chelsee Hamilton. Thank you to my parents, Rick and Teresa, and my brother, Jay. Thank you to my friends, young and old, who have believed in me. Thank you to all my faculty throughout the years who have been sources of inspiration, motivation, and knowledge. Thank you to my amazing patients.

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Publications

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Fields of Study

Major Field: Dentistry

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Introduction and Review of the Literature

When a child suffers from medical problems, the entire family suffers. The American Academy of Pediatrics Task Force on the Family summarized in their recent report, "The health and well-being of children are inextricably linked to their parents' physical, emotional and social health, social circumstances, and child-rearing practices."[1] This is supported by a growing number of studies in the literature addressing the burden of diseases on the family unit. Some of these articles focus specifically on the stress levels of parents as a result of a child's chronic disease. Examples include: cancer,[2] physical disabilities,[2] heart disease,[3] chronic cough,[4] epilepsy, asthma,[5] chronic kidney failure,[6] chronic feeding problems,[7] and developmental delay.[8]

Among chronic diseases of childhood, dental caries is the most common.[9] The Surgeon General's Report on Oral Health in America recognized this fact, and underscored by C. Everett Koop, "You cannot be healthy without oral health."[9] Approximately 41% of children between the ages of two and nine in the US had dental caries during 1999 to 2002 (See Table 1).[10] This Surgeon General's Report and these data recognized that millions of children in the United States suffer from dental disease, and this imposes a tremendous burden on the US population, and more specifically on the US family.

Early Childhood Caries

In 2008 The American Academy of Pediatric Dentistry (AAPD) developed a classification of children under six years of age known as Early Childhood Caries (ECC). ECC is defined as the presence of dental decay, dental restorations, or missing teeth (dmfs) in a patient who is 71 months old or younger. Included in this classification of decay are teeth with incipient caries, or white spot lesions, which are not yet cavitated. Severe early childhood caries (S-ECC) is a classification based on the child's age: any caries in a child younger than three, a decayed-missing-filled surface (dmfs) score greater than or equal to four (age three), dmfs greater than or equal to five (age four), or dmfs greater than or equal to six (age five).[11]

Despite the last efforts of the American Academy of Pediatrics and the American Academy of Pediatric Dentistry, there is substantial evidence that early childhood caries is on the rise. The National Center for Chronic Disease Prevention and Health Promotion reported that dental caries in two to five year-old children has increased from 24% in the period from 1988 to 1994 to 28% in the period from 1999 to 2002. [10] Within this same time period (1997 to 2001), program directors of pediatric dentistry programs reported a perceived increased demand for treatment of preschool aged children. The number of children under three years of age in these clinics increased 85% during this period. [12]

It has been shown that two to six year-old children with acute dental pain have significantly more discomfort and pain than a caries-free control group, as well as changes in temperament, moods, global behavior, and impact on parents' time. [13] An earlier study indicated that children with ECC reported significantly more pain,

interference with sleep, interference with play, and dissatisfaction with teeth compared to matched caries-free controls. [14]

Contemporary approaches to cariology and dental epidemiology

While biological factors describe in a general sense how the caries process occurs, it appears that the progression of early childhood caries is the product of a complex series of ? interactions. Concurrent with the increasing number of studies of the socio-demographic burden of chronic disease in the literature is a paradigm shift in pediatric dentistry and dental epidemiology. Children's oral health is now understood to be the result of multiple determinants on a variety of levels, including community-level influences, family level influences, and child-level influences. All three of these levels are shaped by time and the environment (See Figure 2).[15] A major component within the family-level sphere of influences is parental stress. Additionally, one can view ECC through a morbidity and mortality model. Looking beyond a strictly biological model, it is evident that many nonbiological factors play an instrumental role in the development of ECC. [16]

Treatment of ECC under general anesthesia

The literature provides support for treatment of ECC under general anesthesia. In a recent study by White et al., which questioned parents two to four weeks after their child's dental treatment under GA, 84% of parents reported no pain, and 60% of parents reported that there was improvement in the child's overall health.[17] An earlier study found significant improvement in a child's well-being four to eight weeks after dental

rehabilitation under GA. The treatment reduced pain (84% of patients), improved the quality of life (65% of patients), and improved eating and sleep.[18] Acs et al. found that quality of life was improved by dental treatment under GA and that 99% of parents were satisfied with the procedure. Pain was reduced in 86% of patients, eating was improved in 69%, and sleep was improved in 41%.[19] Despite this short-term improvement, many children treated under GA will develop new caries within the next two years. [20] Vinckier et al. reported that 81.6% of parents would choose to have their child treated again under GA if necessary, and the remaining 18.4% of parents would elect for GA if no other treatment modalities were available.[21] Parents tend to prefer general anesthesia over passive restraint and oral sedation.[22]

Despite the favorable parental support for dental treatment under GA, the treatment can be stressful for the children, as well as the parents. Parents reported feeling troubled that GA was necessary to treat their child. Although many parents felt guilty that their child was being treated under GA, some parents felt blameless.[23] When parents were in the operating room during induction of anesthesia, it was found that their heart rate and skin conductance levels were higher than those of parents who were not present during induction.[24]

Barriers to dental treatment under general anesthesia

Management of dental caries in a young child is often affected by a number of barriers. Social barriers, economic barriers, and access to care are important issues to consider for many child patients. An Australian study found that four and five year-old children were more likely to have dental caries if they breast fed from three to six months

old, sipped from the bottle, were an ethnicity other than Caucasian, or had an annual family income less than the equivalent of approximately $27,400 USD.[25] Among other variables are availability of transportation, finances, and dental insurance coverage.[26]

Studies of parental stress

When approaching the relationship between chronic disease and parental stress, there are two obvious approaches. The first, and most common, approach is to investigate the effect of chronic disease on parental stress.[2, 3, 5, 6, 8] The second approach is to investigate the effect of parental stress on chronic disease.[7, 27] It is sometimes difficult to distinguish between these two scenarios and is difficult to establish causality.[28]

There are multiple instruments that have been used to assess parental stress. The Symptoms Checklist 90 is a common psychological questionnaire that addresses a very wide range of issues.[29] Another option is the Depression, Anxiety, and Stress Scale (DASS).[4] Increasingly more common is the Parenting Stress Index (PSI), which is useful in a variety of clinical settings. The test can be administered and scored by individuals who do not have formal education in psychology.[30, 31] The PSI has been demonstrated to predict risk of parental maltreatment of children.[32] Due to the lengthy nature of the PSI, Abidin also developed the PSI Short Form (PSI-SF).[30] The PSI-SF has been used in a number of studies.[2, 3, 5, 7, 8, 28] In a low-income, predominantly African American population, the PSI-SF was found to have excellent internal consistencies.

Abidin, in 1982-1983 compiled his normative population from among 2,633 mothers recruited primarily (41%) from well-child-care pediatric clinics in Central

Virginia. His metholodology was as follows: "The current norm sample consisted of the 534 mothers from the initial PSI norm sample (Abidin 1983), plus 2,099 mothers who were recruited between 1983 and 1989. The sampling procedure was not random or stratified and primarily represents an opportunistic approach to gathering data. The common characteristic of the data-gathering procedure was that parents were volunteers who were approached by staff members of the clinics, schools, or centers that were serving the children." The mean age of mothers was 30.9 years (range 16-61). The ethnic composition was overwhelmingly Caucasian (76%) followed by: 11% African American, 10% Hispanic, and 2% Asian. The mean number of children living in the homes of the sample was 2.1 (SD = 1.2). The children who were the focus of the PSI, the target children for the sample, ranged in age from 1 month to 12 years of age, with a mean of 4.9 years (SD = 3.1). Abidin also compiled data from 200 fathers. These subjects had a mean age of 32.1years ±6.0. Mirroring the maternal population, there was an majority of Caucasian fathers (95%) and 5% African American.

Dental treatment and parental stress

Although the number of studies in the dental literature on parental stress and children's dental caries is limited, existing studies suggest a positive relationship. Incidence of caries in abused children in Canada was found to be almost twice as high as that of the general population.[33] A large study of four to six year-old children in Australia found that children of parents who scored high on parenting stress in the PSI-SF had an increased rate of caries. Higher caries activity was also associated with low SES and defensive responding on the PSI (an indicator that parents were responding with

expected answers rather than candid answers). [28] LaValle et al. found that increased caries activity in five to twelve year-olds was related to low parental education, young parents, and low Child Domain score on the PSI. The low Child Domain score suggests that these parents had lower expectations of their children in general, including oral health. As the age of the children in this study increased, parents were more likely to bring the child in for the recommended number of appointments. [27] Finlayson et al. found conflicting results using slightly different study methods in a survey of parents of low-income African American children in Detroit. In this survey, the investigators used eight questions from the PSI and assessed caries using the International Caries Detection and Assessment System ICDAS to study 719 children. They found that ECC was positively associated with the child's age and lower parental stress. The authors were surprised with these findings and believe the subject warrants further investigation. [26]

Pilot data

Burns et al. [34] studied parenting stress in parents of children with and without dental caries. They used the 36 question Parenting Stress Index-Short Form (PSI/SF). Children were dichotomously placed into caries-free (no lesions) and caries (six or more lesions) groups. The investigators found a significant relationship between the level of parental stress and the number of carious teeth. These results can be interpreted that there is a quantifiable difference in parenting stress between parents of children with caries and those without, and that the stress is higher in those with more caries. Although the PSI/SF is not designed for serial administration, the investigators administered the instrument again at 90 days for any children requiring treatment. They found a

significant decrease in parenting stress for the parents of the children who were treated, and an increase in parenting stress for those who were not treated. Because the PSI/SF was a state rather than a trait instrument, it is possible that the difference found was situational rather than chronic.

Objectives

The purpose of this study is to assess whether full mouth rehabilitation under general anesthesia has an effect on parental stress as assessed by the PSI at a one to three month follow-up.

Methods

This cohort study was conducted in a large urban teaching hospital. All research was conducted in the hospital dental clinic and surgery center. The subjects were available and recruited as parent-child dyads if they met inclusion criteria and agreed to participate in the study. This protocol was approved by the hospital's Institutional Review Board (IRB).

Study Population

Multiple children of parents were not included in the study (i.e. only one parent-child dyad was represented per family). Indications for treatment under general anesthesia included: extensive restorative treatment required, child's inability to cooperate, and long distance from home to the dental clinic. The age range of patients included in the study was 18 months to 71 months, and the minimum weight limit was 10 kg. Demographic information was collected on the data sheet (See Table 2).

The following information was collected from the parents: caregiver name, primary phone number, caregiver age, caregiver gender, number of caregivers in home (1 or 2+), caregiver graduation level (less than high school, high school, college, post graduate), annual household income (less than $20,000; $20,000 to 40,000; $40,000 to

$60,000; $60,000+), ethnicity (African American, Hispanic, White, other), child's birthdate, child gender, and number of siblings in home.

Power Analysis

Using JMP 8.1 and data from the pilot study, it was determined that it would be necessary to recruit 72 subjects to achieve a power of 0.95. A power of 0.80 was determined to require 43 subjects. It was anticipated that the attrition rate would be approximately 28%, thus 100 subjects were recruited, in order to allow for a power of 0.95 or higher.

Recruitment

Parent-child dyads were recruited from the dental surgery center on the morning of the operation (t_0). Parents were invited to participate in the study after induction of general anesthesia. The parents received a packet containing five items: the PSI, the PSI answer sheet, IRB consent form, screening form, and a parent letter explaining the study in lay terminology. All questions about the informed consent and questionnaires were answered, and the parent was asked to complete the survey in the reception area. If two parents were present, one parent completed the documents.

Inclusion in the study required:

- Minimum of six carious teeth
- ASA I or ASA II
- Treatment under general anesthesia (GA).

Exclusion criteria included:

- ASA III or higher
- Child is adopted
- Child is in foster care
- Primary language other than English.

Data Collection

Caregiver information was assessed using a standardized information sheet. Demographic information included caregiver name, phone number, age, sex, marital status, graduation level, and annual household income. Child information included date of birth, ethnicity, and number of siblings in the home. It was also noted whether the patients came through the clinic as an emergency or new patient.

As per the routine in the dental surgery center, each child received a thorough clinical exam and appropriate radiographs while under general anesthesia. The clinical section of the participant questionnaire included a count of the number of decayed teeth clinically visible, presence of infection or pain, and a plaque index score.

Once the questionnaire, examination, and any treatment needed that day were completed, the patient was sent to the post-anesthesia care unit for recovery and dismissal. Parents were contacted by phone to schedule a return visit for the parents to schedule a visit to complete the follow-up PSI at three months (10 to 14 weeks) (t_1). Parents received a $25 gift card to a local grocery store as an incentive to return and complete the follow-up PSI at t_1.

Parenting Stress Index

The Parenting Stress Index consisted of 120 Likert-type questions, and it took approximately 20 to 25 minutes to complete. A follow-up PSI was completed one to three months after the initial exam and screening.

Scoring of the PSI

The PSI was scored as described in the PSI Manual. The PSI was divided into two different domains. Each answer on the PSI answer sheet was assigned a value. The scores for each category were totaled to determine the Raw Score. The Raw Scores were then compared to the normative data in order to determine the percentage of the individual category. A subset of the questions was scored to indicate Defensive Responding. The Child Domain was divided into six subscales: Distractibility/Hyperactivity, Adaptability, Reinforces Parent, Demandingness, Mood, and Adaptability. The Parent Domain was divided into seven subscales: Competence, Isolation, Attachment, Health, Role Restriction, and Spouse. The 20 Life Stress questions also received a raw score, which was converted into a percentage.

Statistical Evaluation

Statistics were analyzed by Dr. Thikkurissy using JMP 8.1. Data were analyzed using paired t-tests. Attrition bias was assessed by comparing the subjects who followed up with all subjects who were initially enrolled in order to determine if attrition bias occurred. Other potential sources of bias were eliminated using the Defensive Responding score. PSI scores were correlated with the demographic variables as well as plaque scores to determine if any relationships among these variables existed.

Results

Demographics

Ninety-four caregiver-child dyads were enrolled in this study and completed the initial PSI questionnaire. Forty caregivers (43%) completed the follow-up PSI questionnaire. Therefore, for the purposes of data analysis N=40.

The mean of the age of children was 43 months (±12.5). All patients were ASA I or ASA II, with 28 (70%) classified as ASA I, 6 (15%) classified as ASA II, and 6 (15%) with an unknown/not reported ASA status. Mean caregiver age was 27.4 years (±8.3). Thirty-three (82.5%) of these caregivers was female, while seven (17.5%) of the caregivers was male. The majority of the homes had at least two caregivers with 32 (80%) having two or more caregivers and 8 (20%) having only one caregiver. When asked about ethnicity, 28 caregivers (70%) identified themselves as Caucasian caregivers, followed by 7 (17.5%) African-American caregivers, one (2.5%) Hispanic, and four (10%) who categorized themselves as "Unknown" or "Other." Twenty-four (60%) of the caregivers reported their annual household income as less than $20,000 per year; nine (22.5%) reported $20,000 to $40,000 per year; four (10%) reported $40,000 to $60,000 per year; and only one (2.5%) reported an income of at least $60,000 per year. Seven caregivers (17.5%) reported that they did not graduate from high school, 23 (57.5%) reported that they were high school graduates, seven (17.5%) reported graduating from

college, one (2.5%) reported completing a post-graduate education, and two (5%) did not report their educational status. A summary of this information is presented in Table 2. The mean follow-up time was 2.5 months (±0.9), with a range from one to six months.

Dental Examination

The average number of carious teeth per patient was 9.6 (±3.4), with a range of 2 to 17 carious teeth. The average number of sextants with pain and/or infection was 0.26 (±0.45). The Plaque Index was assessed as covering at least half of the clinical crown in 17 patients (42.5%), covering less than half of the clinical crown in 10 patients (25%), covering only the gingival third of the crown in 6 patients (15%), and unknown in 7 patients (17.5%).

Parenting Stress Index, Initial

PSI scores were obtained for all 94 of the parent-child dyads who were originally recruited for the study. The mean PSI scores for all 94 patients can be found in Table 3.

The Defensive Responding score was 32 (±9), with seven caregivers being at or below the threshold score of 24. The Total Stress score for the population was 212.8 (±41.6), which is between 35 to 40% of the normative values. The Life Stress score was 13 (±7), which is between 80 and 85% of the normative values. The score for the Child Domain was 98.6 (±20.8), with individual subscales as follows: Distractibility/Hyperactivity 25 (±6), Adaptability 27(±6), Reinforces Parent 9 (±3), Demandingness 18 (±6), Mood 9.4 (±2.7), Acceptability 11 (±4). All the subscores

within the Child Domain fell between the 40th and 70th percentile of the normative values. The Child Domain score fell at the 50th percentile of the normative values.

The score for the Parent Domain was 114.2 (±24.8), with individual subscores as follows: Competence 26 (±5.5), Isolation 14 (±4.6), Attachment 11 (±3), Health 13 (±4), Role Restriction 16.9 (±5.9), Depression 17 (±5), Spouse 17 (±6). All the subscores within the Parent Domain fell between the 35th and 70th percentiles of the normative values.

Parenting Stress Index, Follow-up

The Defensive Responding (DR) score was 32.3 (±10.2), with 7 caregivers being at or below the threshold score of 24. Three of these caregivers also scored low in the DR score at their initial visit. Four of the caregivers with low DR at the initial visit scored above the threshold at the follow-up, while four of the caregivers who scored above the threshold at the initial visit scored below the threshold at the follow-up. The Total Stress score for the population was 214.9 (±50.6), which is between 40 and 45% of the normative values. The Life Stress score was 12 (±7.3), which is 80% of the normative values. The score for the Child Domain was 99.8 (±25.1), with individual subscales as follows: Distractibility/Hyperactivity 24 (±5.4), Adaptability 24.9 (±7.8), Reinforces Parent 9.7 (±) 3.9, Demandingness 18 (±5.6), Mood 10.2 (±3.5), Acceptability 12.3 (±4.8). All the subscores within the Child Domain fell between the 50th and 65th percentile of the normative values. The Child Domain score fell at the 55th percentile of the normative values.

The score for the Parent Domain was 115 (±)29, with individual subscores as follows: Competence 26.3 (±7.8), Isolation 13 (±5), Attachment 11 (±3.4), Health 12 (±4), Role Restriction 17.4 (±5.7), Depression 18.3 (±6.2), Spouse 16.9 (±6.1). All the subscores within the Parent Domain fell between the 35th and 65th percentiles of the normative values.

Comparison of Initial and Follow-up PSI Scores

The PSI scores for the 94 subjects who were recruited for the study were compared with the initial PSI scores of all the patients who eventually followed-up (Table 4). No significant differences were seen between these two subsets.

The PSI scores from the initial and follow-up visits were compared using the paired t-tests (See Table 5). Total score changes for the population are shown if Table 6. The similarity between the initial and follow-up PSI scores is visible in Figure 4. In the Child Domain, there were significant changes within three of the six subscales. Adaptability decreased from 27 to 24.9 (p=0.034), Reinforces Parent increased from 9.0 to 9.7 (p=0.039), and Mood increased from 9.4 to 10.2 (p=0.038). There were no significant changes in any of the subscales in the Parent Domain, although there was a near-significant decrease in the Health score (p=0.108) and a near-significant increase in the depression score (p=0.076).

Three (7.5%) of the initial respondents had high scores in all three categories of Total Stress, Life Stress, and Health in the initial PSI, but only one of the subjects maintained this score into the follow-up. All three of these subjects had DR scores that were above the threshold of 24.

Discussion

Demographics

The study population was compared to a normative population as described in the PSI manual (See Table 7). [30] Data collected for the normative population were taken from a population of 2,633 mothers and 200 fathers, with children's ages ranging from one month to 12 years. Data for this study were taken from a population of 33 mothers and seven fathers with children ranging in age from 25 months to five years nine months. The normative educational levels listed were divided by caregiver gender. The populations were similar in regards to distribution of the populations by race and by mothers' education level compared to the normative population. The population studied reported themselves to have a lower annual income, with 27% of the normative population with a household income below $20,000 and 60% of the study population at that level. No questions as to number of persons in household were asked, so true relation to federal poverty level (FPL) could not be assessed.

Subjects were selected for this study on the day of the child's dental surgery if they met the inclusion criteria. Following the informed consent process, the parent was enrolled in the study, and completed the PSI. A large subset of Dental Surgery Center (DSC) patients were excluded due to special needs of the patient that violated the exclusion criteria or due to lack of English proficiency (i.e. primary language was

Spanish, Somali, etc.). Parents who were visibly distressed on the day of the surgery were not invited to participate in the study due to a potential confounder of acute distress. Although they did not explicitly meet any of the exclusion criteria, the investigators felt that it was not in the best interest of the family to add another burden to this acutely stressed population.

Of the initial 94 who completed the PSI, 43% returned within the 2-3 month period to complete a follow-up PSI. The PSI has test-retest reliability coefficients of 0.63 to 0.77 for the Child Domain, 0.69 to 0.91 for the Parent Domain, and 0.88 to 0.96 for the Total Stress score. The attrition rate in this study (57%) can be attributed to changes of addresses and/or phone number as early as one to three months following their surgery. It is suspected that this difficulty with follow-up is reflective of difficulties that this population faces in general. Several of the parents expressed difficulty getting transportation to the dental clinic for follow-up. Although distance traveled to the clinic was not assessed in this study, many caregivers reported traveling more than one hour to reach the dental clinic. This is consistent with the data demonstrated in previous studies at this institution. Data from the 94 subjects who initially enrolled in the study were compared with those of the 40 subjects who completed the second PSI questionnaire. There were no significant differences found between these two groups. The similarity between those who completed the study and those initially enrolled is a relatively reliable indicator that the subjects who followed up are representative of all the subjects who enrolled in the study. This indicates that selection bias probably did not occur as a result of attrition.

Carious Teeth and Plaque Index

The number of carious teeth (9.6 ± 3.4) was plotted against the Plaque Index score. The plaque index used was the World Health Organization. [35] The maxillary incisors were evaluated for the amount of plaque found on the facial surfaces. If there were no maxillary anterior teeth, the mandibular incisors were evaluated. Findings demonstrated a strong positive linear relationship between the number of carious teeth recorded and the Plaque Index ($R^2 = 0.9162$) (See Figure 3). Plaque was found in all of the children in the study. Children with plaque only in the gingival third of the tooth had an average of 8.3 carious teeth, children with plaque covering half of the clinical crown had an average of 9.9 carious teeth, and children with plaque covering the entire crown had an average of 10.4 carious teeth. The high R^2 coefficient of determination indicated an excellent goodness of fit.

Although this was not a study in cariology, relevance can be found in the finding that children with more plaque also had more caries. In the past decade, the ecological plaque hypothesis has become the predominant theory. This theory states that the ecological system of the biofilm has much more to do with the development of caries than the amount of plaque, but the findings of this study support previous findings that the amount of plaque is still important in the development of caries.[36]

Baseline Parenting Stress

The PSI scores of the 94 subjects who were initially enrolled in the study were compared with the scores of the normative population using paired T-tests (See Table 3). There was not a significant difference in the Child Domain score compared to the norms,

but there were three subscales with significantly different scores. The Acceptability (AC) score was 12.6 (± 3.5) in the normative population compared with 11 (± 3.4) in the study population. This indicated that the children in the study population met parental expectations more than the children in the normative sample. In other words, compared to the normative population, the parents of the study group were less disappointed with their children. This difference could potentially be explained by the parents of the study population having lower expectations for their children than those of the normative population.

The Mood (MO) subscale was 9.7 (± 2.9) in the normative group, whereas it was 10.4 (± 3.2) in the study population. This higher Mood subscale in the study group may have been an indicator of affective dysfunction, i.e. that the children were unhappier than the children in the normative population.

The Reinforces Parent subscale was 9.4 (±2.9) in the normative population and 8.2 (± 2.3) in the study population. This indicated that the parents in the study population felt as if they had greater positive interaction with their children than the parents in the normative population.

The score for the Parent Domain was significantly lower in the study population 110.6 (± 25.1) compared to the normative population 123.1 (± 24.4). All of the individual subscales under the Parent Domain were significantly different from those of the normative population. All of the subscales under the Parent Domain were lower than those of the norms, indicating lower stress, except for Isolaton (IS) and Health (HE). The higher IS score of 14.3 (± 11.2) versus 12.6 (± 3.7) indicate that the parents in the study

population feel more detached from their social network than the parents in the normative population. The higher HE score of 12.5 (± 3.9) versus 11.7 (±3.4) indicate a slightly lower perception of parent health in the study population versus the normative population. The HE scores may or may not be related to parenting.

The Total Stress score of the study population, 208 (± 41.4), was lower than that of the normative population, 222.8 (± 36.6), indicating lower parental stress. However, the Life Stress of the study population, 12 (± 7) was higher than that of the norms, 7.8 (± 6.2), indicating higher life stress. The Life Stress score is an indicator of situational stress that occurs outside the scope of the parent-child relationship. Thus, the study population perceived that they were experiencing less parenting stress, but higher overall life stress than the normative population.

In summary, compared to the normative population, the sample population exhibited a statistically similar score in the Child Domain, with more children meeting parental expectations and less child happiness. Parent Domain scores were lower than the normative population, with less parental depression, greater attachment, less role restriction, greater feeling of parenting competence, greater feeling of isolation from the social network, better relationship with spouse, and worse health. Total Stress scores were lower than the normative population and Life Stress was higher. Although the parent-child relationships were very complex, this population exhibited lower parenting stress but higher overall life stress. It can be concluded that this was, on average, a highly stressed low-income population with a unique parental stress profile and somewhat dysfunctional parent-child relationships.

Some limited comparisons can be made between the stress scores of the study population data and the existing literature. Using only eight items from the PSI Finlayson et al. found an inverse relationship between parenting stress and ECC. [26] They hypothesized that this relationship was indicative of increased parental awareness or adaptive ability that is perceived as distress. Similarly, LaValle et al. found that parents with a low Child Domain score had higher levels of caries. [27] The authors presented a very comparable interpretation of the data. In the case of the present study, direct comparisons may not be drawn from these differences in PSI scores because the health of the normative population (including oral health) was not assessed.

Effects of Full-Mouth Rehabilitation on Parenting Stress

It was found that most of the PSI subscales remained the same between the initial visit and the follow-up (See Table 5, See Figure 5). The three that changed significantly were decreased Adaptability, increased Reinforces Parent, and increased Mood, which were all subscales within the Child Domain. None of the scores in the Parent Domain changed significantly before and after dental treatment.

The finding that most of the subscales did not change significantly, and that the data were evenly distributed, suggests that dental treatment did not have a major effect upon parenting stress. These results must be interpreted with caution. It is intuitive that relief of pain and/or infection through dental treatment would have the potential to decrease parental stress. However, very little change in parenting stress was seen in this study. It is possible that there was a decrease in parenting stress in this study, but this study was inadequately powered to detect it. It is also possible that there were

confounding variables that were not accounted for in the inclusion/exclusion criteria, Life Stress, and Defensive Responding. Such confounders might include stress caused by other children in the household or acute stress at the time of the surgery.

In this population, which was primarily reported low income and high stress, it was quite possible that dental considerations had low impact on the parents' overall lives. Clinically, dental caries within this population was a chronic disease which is treated only with acute exacerbation. At the initial and follow-up visits, Life Stress scores were at and above the 80th percentile compared to norms, respectively. Recent dental literature suggests that suggests that dental concerns should be considered within a greater context of consisting of a constellation of psychosocial concerns. [16] [15] The findings of this study corroborated these findings.

The finding that there were no major changes in parenting stress detected in this study should not lead to the conclusion that dental treatment under general anesthesia is unnecessary or unimportant. Although the PSI has been used before in dental settings, this is the first time that the authors are aware of that the PSI has been used to evaluate changes in parenting stress before and after dental treatment.[27] Parenting stress should be considered as an important, yet limited, indicator of dental treatment. This study is consistent with other studies that showed a positive relationship between dental caries and parental stress [37] and low income. [28]

Despite the overall stability of PSI scores before and after dental treatment, there were changes in three of the subscales. The Adaptability score decreased from 27(±6) at the initial visit to 24.9 (±7.8) at the follow-up. The Adaptability score represents the

ability of the child to cope with changes in environment. Changes in the physical environment include daily routines and sensory stimuli, while changes in the social environment include performing tasks and interaction with strangers. The reduction seen in the Adaptability score can be seen as an improvement in this subscale. It is intuitive that an intervention such as dental treatment that relieved pain and/or infection was associated with a child's ability to adapt to their surroundings.

The score for the subscale of Reinforces Parent increased from 9.0 (±3.0) initially to 9.7 (±) 3.9 at the follow-up. An increase in this subscale indicates an increase in negative reinforcement. Parents who score highly in this subscale often report that they feel a sense of rejection from their child, and high scores may indicate that the child has a neurological disorder, depression, poor communication with the parent, or a depressed parent. Intuitively, it was anticipated that a child who received dental treatment would show a decrease in this category, rather than the increase that was found. A score of 9.7 was not exceptionally high, falling at the 65th percentile, but there was no clear explanation why the score increased.

The score for the Mood subscale increased from 9.4 (±2.7) to 10.2 (±3.5). High scores in this subscale indicate dysfunctional child affect, and can be reflective of depression, unhappiness, crying, unhappiness, and impaired attachment. As seen in the Reinforces Parent subscale, the change in the Mood score was a significant but modest worsening of the score. The score of 10.2 was located at the 60th percentile, and it was not clear why the score increased.

Although the worsening of the scores for the Reinforces Parent and Mood were significant, it is questionable whether such a change is clinically significant. One thing that is clear from this study was that these children were difficult for the caregivers to manage. It appears from the results of this study that the children in this population became slightly more difficult to manage after having a full-mouth dental rehabilitation under general anesthesia, but it was unclear exactly why. These findings support the surprising findings of Finlayson et al. in which lower parenting stress (assessed by using only eight items from the PSI) was found to be positively associated with ECC. [26]

In this study, all of the significant changes in the PSI between the initial visit and the follow-up were in the Child Domain. When scores in the Child Domain are high, there may be attributes of the children that make parenting of these children difficult. High scores in the child domain may be interpreted as child-related problems in the parent-child dyad. When psychologists target interventions of families with high Child Domain scores relative to Parent Domain and Life Stress scores, they focus on changing child behaviors.

Life Stress

High Life Stress scores indicated that parents were experiencing stress in their lives from events beyond their control. This score served as an indicator that these parents were experiencing high levels of stress from situations that were not associated with their child. High scores in the Life Stress category tended to increase the impact of cumulative life stressors upon the parents.

The high Life Stress scores of 13 (±7) initially and 12 (±7.3) at the follow-up, which were both at approximately the 80th percentile compared to norms, indicated that this was a very stressed population in general. The stability of the Life Stress scores indicated that these families were living with high levels of baseline stress. Thus, one might not expect to see big changes in stress caused by dental treatment alone.

Defensive Responding

Two indicators of social desirability in the PSI are Defensive Responding and low Total Stress scores (TS<15%). Scores of 24 or below indicate either a high level of defensive responding (false negative) or significantly low level of parenting stress compared to the normative population (true negative). There were 13 parents who scored low on either the initial or follow-up total stress category. There were seven parents who scored low on initial DR, and seven parents who scored low on follow-up DR, and only three of these were the same parents. Parents with low DR scores scored significantly lower on Total Stress than those with high DR scores (p=0.013). Three of the respondents had a "triad" of high Total Stress, Life Stress, and Health, and only one of these parents maintained this score into the follow-up. All three of these subjects had good DR scores.

Parents who scored low in Total Stress could be explained by actual low total stress (true negative), defensiveness (false negative), dishonesty (false negative), or disengagement (false negative). Although it was not assessed whether grandparents or other family members helped care for the children in this study on a regular basis, it is possible that a large burden of the parenting was shared by extended family members.

Such parents may have indeed felt less stress because they were receiving a substantial amount of parenting help from other family members.

Differences Between Male and Female Caregivers

The PSI reference manual provides additional information about male caregivers, and it was anticipated that there might be some distinct differences between the male caregivers, compared to the caregivers as a whole, so they were analyzed separately as a subset. The male caregivers showed a dissimilar education level compared to the normative population (See Table 8). In the study population, all of the male caregivers reported completing a high school education, while the males in the normative sample ranged from less than high school through post-graduate. The difference in these findings can most likely be attributed to the small number of males (seven) who were seen in this study. It has been shown that mothers tend to be more emotionally involved in parenting, and thus will exhibit higher parenting stress scores compared to fathers. Indeed, all the scores in the fathers studied did not show significant differences from the norms except for Life Stress, which was significantly higher in the study population ($p=0.008$). This was consistent with the previous observation that this was a highly stressed cohort overall.

Limitations/Future Research

There are several limitations to this investigation, many of which have been discussed previously. This study did not use a control group, but rather used the study

cohort as its own control. It also relied upon a standardized data set to compare information. This study could have used a caries-free control group as well

Although defensive responding did not appear from the data, it is possible that some of the answers were biased by defensive or deceptive responding. Despite the design of the PSI as an instrument used to measure chronic stress (trait), it is also possible that some of the scores were affected by acute stress (state), altering the results. There was a bias of selection in the elimination of some potential study participants who were acutely stressed and did not appear that they would have the mental clarity to complete the PSI at that time. It is possible that some of the most valuable subjects were eliminated due to this influence of acute parenting stress.

Most of the subjects in this study spoke only English, but some of the patients also spoke another language. It is possible that there were some cultural differences that were not accounted for that could have affected the scores. Although the PSI has been validated in a number of languages, comparisons between PSI scores in different languages is problematic due to inherent cultural differences of the populations being studied. In the future, the relationships between parenting stress and dental caries could be intentionally studied.

The attrition rate was 57%, and it is possible that some bias in the study occurred due to selective pressures that prevented some of the parents returning to the clinic to complete the follow-up or mailing the PSI back in for follow-up. Included in these pressures are changes/instability in residence and phone number and transportation difficulties.

This is the first study that the authors are aware of that assessed pre- and post-operative parenting stress of children being treated under general anesthesia. More research in this area with a larger number of subjects is needed.

Summary/Conclusion

This longitudinal study compared the pre- and post-treatment Parenting Stress Index scores with normative data in parents of children who were being treated under general anesthesia for at least six carious teeth. The population was found to be very similar to the normative population except for lower annual income (60% versus 27%) and Life Stress (80^{th} percentile compared to norms). There was a strong positive linear relationship between the number of carious teeth recorded and the Plaque Index (R^2 = 0.9162). There were changes one to three months post-operatively in three of the subscales: improvement in Adaptability (p=0.034), worsening in Reinforces Parent (p=0.039), and worsening in Mood (p=0.038). Male caregivers showed no differences from male norms except on Life Stress (p=0.008). Additional research is needed in this complex field of study.

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Appendix A: Tables

Table 1 Prevalence of dental caries in primary teeth

TABLE 2. Prevalence of dental caries in primary teeth* among children aged 2–11 years, by selected characteristics — United States, National Health and Nutrition Examination Survey, 1988–1994 and 1999–2002

	1988–1994		1999–2002			
Characteristic	%†	SE§	%	SE	Difference in %¶	% Change¶
Age group (yrs)						
2–5	24.23	1.32	27.91	1.68	3.68	15.19
6–11	49.74	1.77	49.00	2.43	-0.74	-1.49
Sex						
Male	39.50	1.73	43.16	2.53	3.66	9.27
Female	40.24	1.44	38.41	2.25	-1.83	-4.55
Race/Ethnicity**						
White, non-Hispanic	35.76	1.44	37.92	2.33	2.16	6.04
Black, non-Hispanic	40.95	1.65	43.25	2.13	2.30	5.62
Mexican-American	53.52	2.05	54.90	2.52	1.38	2.58
Poverty status††						
<100% FPL	51.10	2.00	55.28	3.01	4.18	8.18
100%–199% FPL	44.40	1.99	45.15	3.25	0.75	1.69
≥200% FPL	31.11	1.61	30.69	1.94	-0.42	-1.35
Total	**39.87**	**1.15**	**40.84**	**1.86**	**0.97**	**2.43**

* Defined as having one or more decayed or filled tooth surfaces among those with at least one primary tooth. All estimates are adjusted by age (single years) and sex to the U.S. 2000 standard population, except sex, which is adjusted only by age.
† Weighted prevalence estimates.
§ Standard error.
¶ Between the two surveys and using 1988–1994 as reference. A positive value indicates an increase, a negative value a decrease.
** Calculated using "other race/ethnicity" and "other Hispanic" in the denominator.
†† Percentage of the Federal Poverty Level (FPL), which varies by income and number of persons living in the household.

Table 2 Population demographics

POPULATION DEMOGRAPHICS (N=40)	
Mean Age of Child	43 months ± 12.5
Gender of Child	
Male	24
Female	16
Child Health Status	
ASA I	28
ASA II	6
Number of Carious Teeth	9.6 ± 3.4
Sextants with Pain/Infection	0.26 ± 0.45
Plaque Index	
Gingival	6
< ½ Clinical Crown	10
> ½ Clinical Crown	17
Mean Caregiver Age	27.4 years ± 8.3
Gender of Caregivers	
Female	33
Male	7
Number of Caregivers in Home	
2 or more	32
1	8
Caregiver Ethnicity	
Caucasian	28
African-American	7
Other	3
Hispanic	1
Reported Annual Household Income	
<$20,000	24
$20,000-$40,000	9
$40,000-$60,000	4
>$60,000	1

Table 3 Recruited subjects versus the normative sample

	Abidin		The Followell 94		
Scale	Mean	SD	Mean	SD	p-values
Child Domain	99.7	18.8	97.3	4.9	0.216
Adaptability (AD)	24.9	5.7	25.6	6.8	0.245
Acceptability (AC)	12.6	3.5	11	3.4	*<0.0001*
Demandingness (DE)	18.3	4.6	18.5	5.6	0.618
Mood (MO)	9.7	2.9	10.4	3.2	*0.022*
Distractibility/Hyperactivity (DI)	24.7	4.8	24.1	5.7	0.2371
Reinforces Parent (RE)	9.4	2.9	8.2	2.3	*<0.0001*
Parent Domain	123.1	24.4	110.6	25.1	*<0.0001*
Depression (DP)	20.3	5.5	17.2	5.5	*<0.0001*
Attachment (AT)	12.7	3.2	10.4	3	*<0.0001*
Role Restriction (RO)	18.9	5.3	17.1	4.9	*0.0012*
Competence (CO)	29.1	6	25.3	5.7	*<0.0001*
Isolation (IS)	12.6	3.7	14.3	11.2	*<0.0001*
Spouse (SP)	16.9	5.1	15.8	6.3	*0.0418*
Health (HE)	11.7	3.4	12.5	3.9	*0.0259*
Total Stress	222.8	36.6	208	41.4	*<0.0001*
Life Stress	7.8	6.2	12	7	*<0.0001*
N	2633		94		

Table 4 All subjects recruited versus scores of subjects who followed up

Initial only VS Initital/FU (p-values)	
Scale	
Child Domain	0.7923
Adaptability (AD)	0.218
Acceptability (AC)	0.336
Demandingness (DE)	0.925
Mood (MO)	0.0717
Distractibility/Hyperactivity (DI)	0.927
Reinforces Parent (RE)	0.571
Parent Domain	
Depression (DP)	0.699
Attachment (AT)	0.356
Role Restriction (RO)	0.912
Competence (CO)	0.465
Isolation (IS)	0.895
Spouse (SP)	0.108
Health (HE)	0.401
Total Stress	0.426
Life Stress	0.237
Overall Stress	0.372

Table 5 Impact of dental treatment on PSI domain scores

Impact of Dental Treatment on PSI domain scores					
Mean Follow-up time 2.5 months ± 0.9					
CHILD DOMAIN(s)		***p-value***		***PARENT DOMAIN(s)***	***p-value***
Distractibility/Hyperactivity		0.769		Competence	0.471
Adaptability		***0.034****		Isolation	0.553
Reinforces Parent		***0.039****		Attachment	0.780
Demandingness		0.958		Health	0.108
Mood		***0.038****		Role Restriction	0.581
Acceptability		0.144		Depression	0.076
				Spouse	0.643
TOTAL Child Domain		0.773		TOTAL Parent Domain	0.840

Table 6 Total score changes in population

TOTAL Score Changes in population	
Total Stress	0.785
Life Stress	0.872

Table 7 NCH data versus normative sample

NCH Data Versus Normative Sample		
Variable	**Normative Sample (%)**	**NCH Population (%)**
Total Family Income		
<$20,000	27	60
$20,000 to $40,000	53	22.5
>$40,000	20	12.5
Ethnicity/Race		
Caucasian	76	70
African American	11	17.5
Hispanic	10	2.5
Other	3	7.5
Educational level of mother		
Less than High School	16	21.2
High school/Vocational	57	48.5
College	25	21.2
Post-graduate	2	3.0
Unknown	0	6.1
Educational level of father		
Less than High School	31	0.0
High school/Vocational	41	100.0
College	24	0.0
Post-graduate	4	0.0
Marital status of mother	Not comparable: Normative sample assesses marital status of mother and NCH sample assesses # of caregivers in home	

Table 8 Fathers

(age of norms 6 months to 48 months, age of NCH avg 47 m), N = 7

Scale	PSI Standards Mean	PSI Standards SD	NCH Initial Mean	NCH Initial SD	NCH Follow-up Mean	NCH Follow-up SD
Child Domain	92.9	11.9	93.9	25.4	91.4	29.6
Adaptability (AD)	22.3	2.7	27.0	6.0	23.3	8.2
Acceptability (AC)	10.0	1.9	10.0	4.0	11.9	4.4
Demandingness (DE)	18.4	3.6	18.0	6.0	18.0	4.7
Mood (MO)	10.2	1.5	9.7	3.2	9.9	4.3
Distractibility/Hyperactivity (DI)	21.8	3.2	23.0	8.0	20.0	6.8
Reinforces Parent (RE)	10.2	2.3	6.0	1.0	8.0	2.2
Parent Domain	108.7	18.4	103.4	27.5	100.0	23.7
Depression (DP)	17.2	4.6	16.0	5.0	15.4	4.0
Attachment (AT)	11.3	2.1	8.0	2.0	10.0	2.9
Role Restriction (RO)	15.6	5.1	15.9	4.5	15.0	4.5
Competence (CO)	26.9	5.3	23.0	5.7	24.4	6.8
Isolation (IS)	10.4	2.8	13.0	4.8	12.0	4.2
Spouse (SP)	15.5	4.9	15.0	5.0	12.7	2.4
Health (HE)	10.9	2.7	13.0	3.0	11.0	1.9
Total Stress	201.6	26.5	197.3	51.7	191.4	52.7
Life Stress	1.8	1.4	8.0	5.0	8.7	5.5

Appendix B: Figures

Figure 1 The caries balance

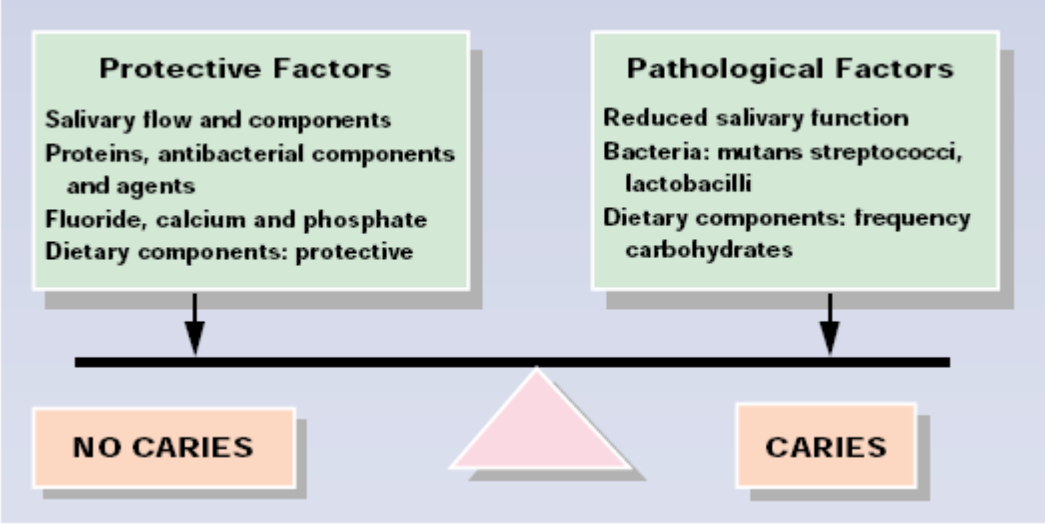

Figure 2 Influences on oral health

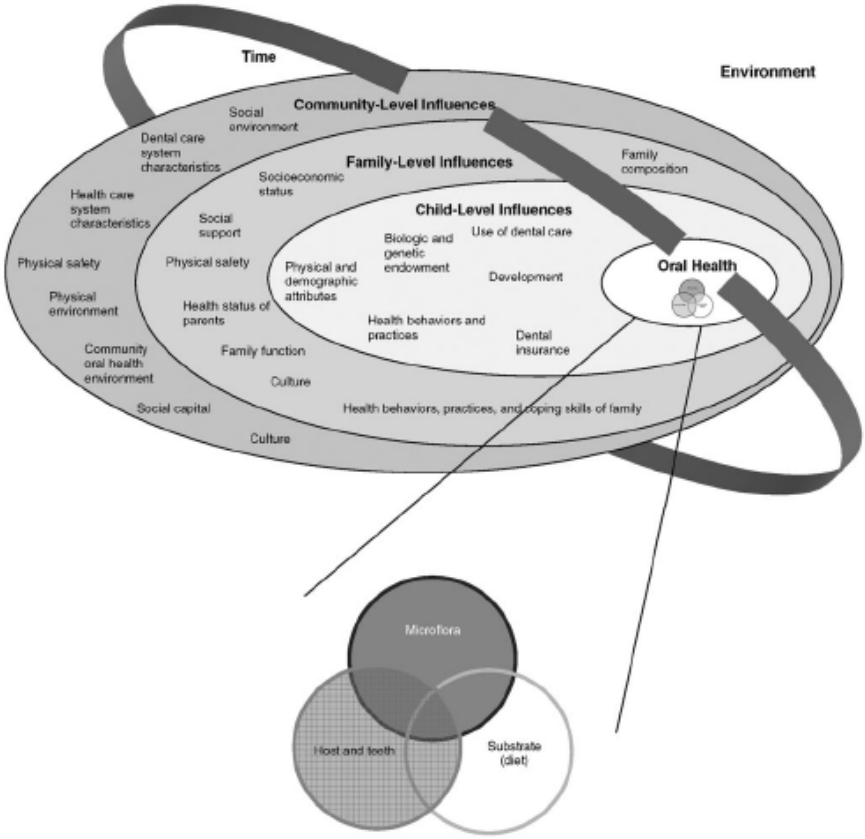

Figure 3 Mean number of carious teeth by plaque index

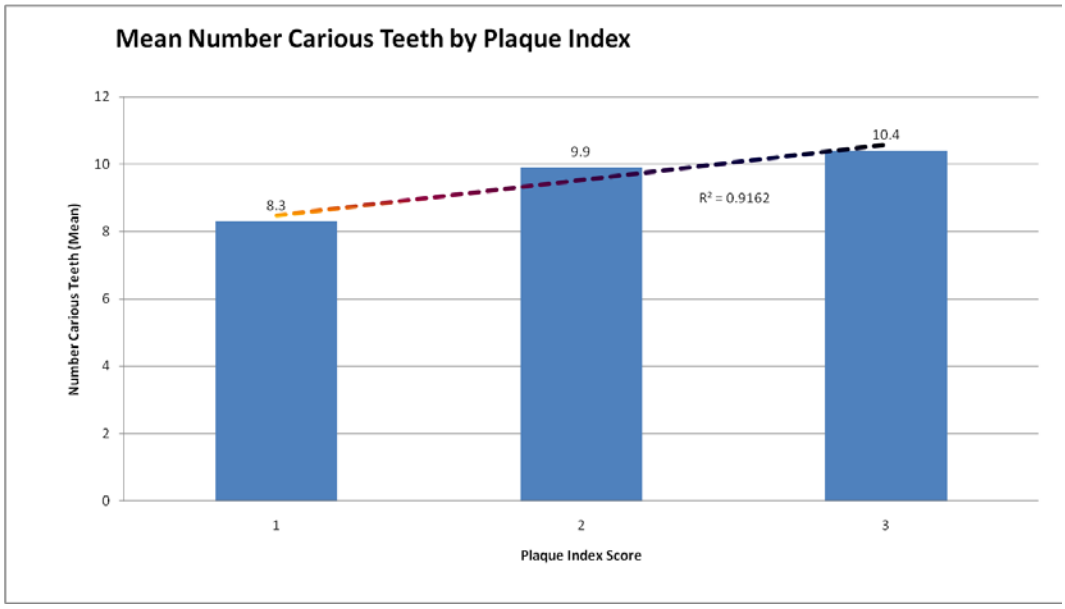

Figure 4 PSI scores for both initial and follow-up

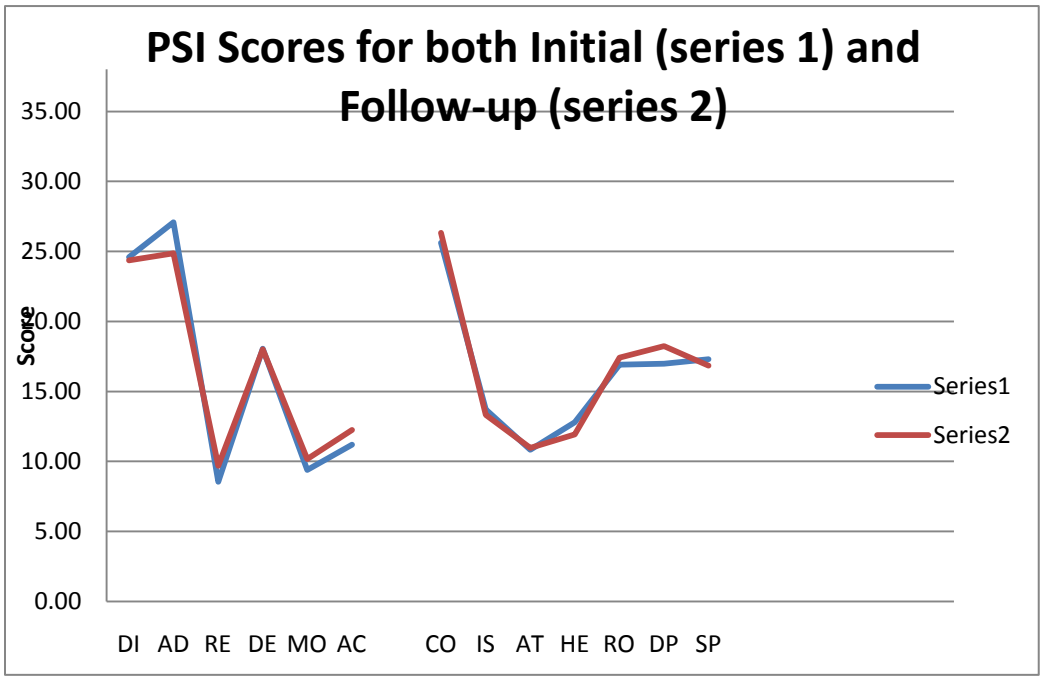

Figure 5 Components of parenting stress

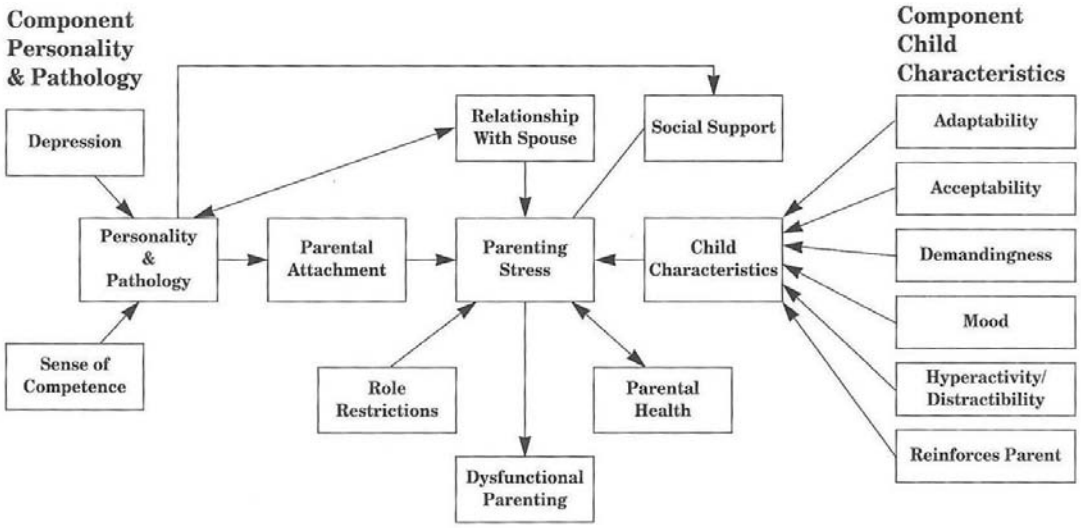

Figure 6 Initial PSI Profile

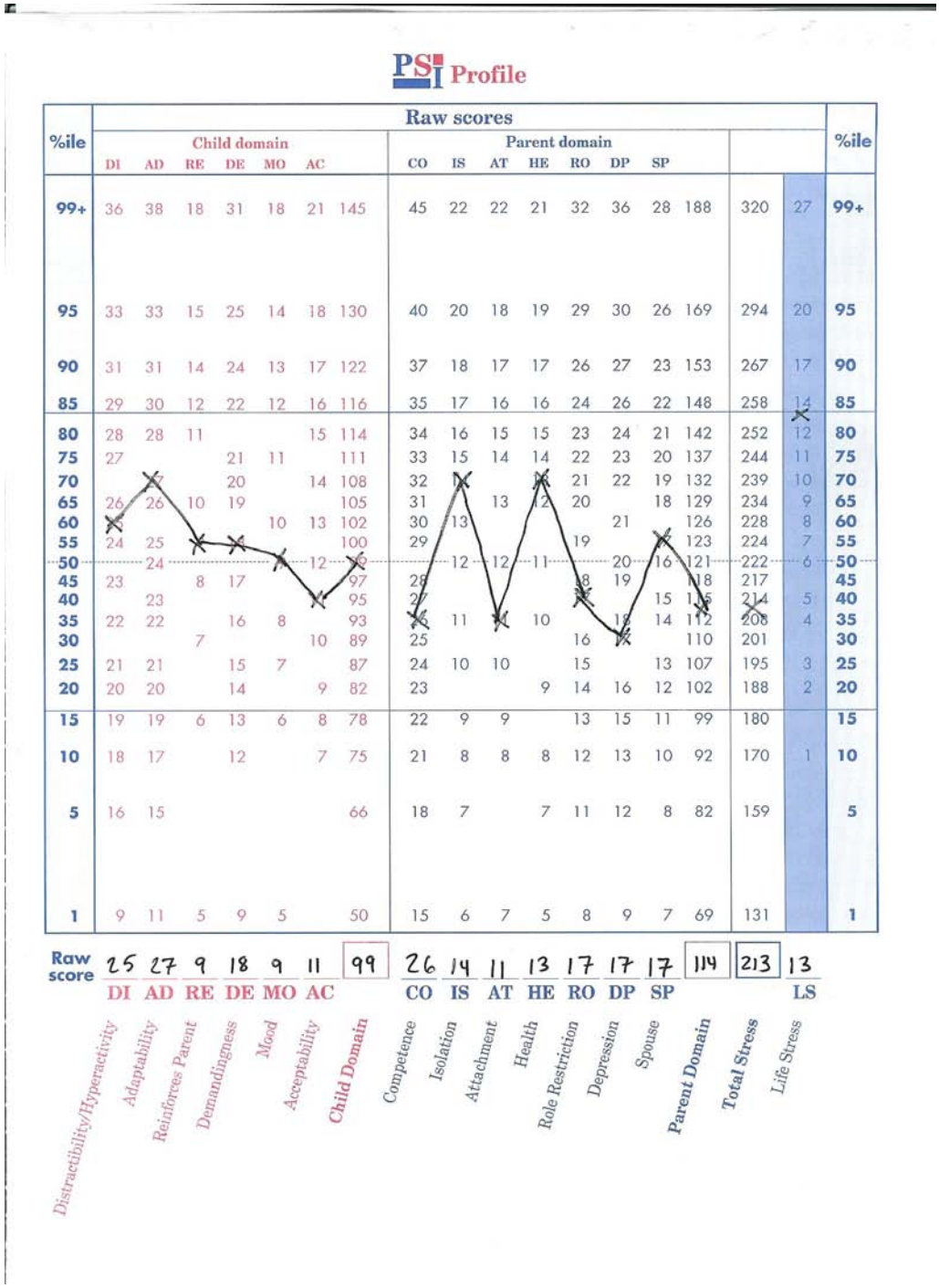

Figure 7 Follow-up PSI Profile