

ORIGINAL ARTICLE

The impact of emotional intelligence and intelligence quotient (IQ) on child anxiety and behavior in the dental setting

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Abstract

Objective. The aim of this study was to evaluate the impact of IQ and EQ on child's anxiety and behavior in the dental setting. **Materials and methods.** One hundred and seven children (age range 7–12 years) were selected. BarOn Emotional Quotient Inventory: Youth Version (Baron EQ-I: YV) and the Raven's Colored Progressive Matrices (RCPM) tests were administered on the first examination session. Children's anxiety and behavior were evaluated using the modified child dental anxiety scale (MCDAS) and the sound, eye and motor (SEM) scales, respectively, during the second session. **Results.** The mean (SD) age of subjects was 8.48 (1.41) years old. The result revealed a significant negative correlation between children's behavior and total EQ score ($p < 0.01$) but there was no relationship found between children's behavior and IQ score. A significant positive correlation was found between anxiety scores on MCDAS and SEM ($p < 0.01$), but no relationship was found between EQ and MCDAS scores. Both anxiety ($p < 0.01$) and EQ score ($p < 0.01$) were effective variables in predicting the child's SEM score. **Conclusion.** The major finding of this research suggested that a high EQ may be more effective than a low EQ in moderating the level of cooperation during dental treatment of children. IQ scores, on the other hand, were related to the child's EQ score ($r = 0.20$) and age ($r = -0.29$).

Key Words: Anxiety, behavior, emotional intelligence, intelligence quotient

Introduction

The dental setting represents a potential stressor for children that may lead to significant fear and distress. Children are particularly threatened by anticipated parental separation, pain, loss of control and by masked strangers working in a highly technical setting [1,2]. Dental treatment involves many potentially unpleasant stimuli, which may lead to the development of dental anxiety and behavioral management problems. It is still unclear why some children get anxious in the dental situation while others, with a comparable dental history, do not. Besides the latent inhibition theory, it is suggested that this can be explained by differences in child rearing and personality traits [3]. Unraveling why some children cope effectively with operative events and others do not has both theoretical and practical implications. Such investigations not only enhance our conceptual

understanding of vulnerability in children to the operative stress response, but also help dentists to identify children who are in greater need of pre-operative interventions. Some factors that may influence a child's response to the dental setting are cognitive abilities, ability to draw on different coping strategies to help with anxious feelings and social adaptive abilities, which are those behaviors that children use to respond to usual or daily experiences [2].

Many psychologists believe the general index of cognitive ability (intelligence quotient or IQ) to be the best single predictor of virtually all criteria considered necessary for success in life in the western part of the developed world [4,5]. The link between low IQ and childhood psychopathology has been registered in many studies [6,7] as well as in a study of children evaluated because of their behavioral problems in schools [8]. Despite the fact that IQ has provided much insight into how and why

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individuals behave in certain situations, IQ tests do not measure how emotions may interfere with a child's capabilities in school and society. A child experiencing anxiety may be quite intelligent but may perform poorly on any kind of test simply due to emotional interference in the brain. Then the ability to adapt to a complex environment which overwhelms traditional intelligence requires skills and traits that lie outside definitions of traditional intelligence.

Emotional intelligence is one of a number of intelligence theories that expand the concept of intelligence to better address the complexities of humans' interaction with their environment [9]. Having coined the term 'emotional intelligence', Peter Salovey and John Mayer proposed a formal definition of emotional intelligence as 'The ability to monitor one's own and others' feelings, to discriminate among them, and to use this information to guide one's thinking and action' [10]. Later, this definition was refined and broken down into four proposed abilities that are distinct yet related: perceiving, understanding, using and managing emotions, which contribute to adaptation in various realms of life [10,11]. There have been studies indicating a relationship between emotional intelligence quotient (EQ) and life adjustment [12]. Following these earlier works, there is continuing interest in exploring EQ and various aspects of life adjustment [13–15]. A large number of studies with children further suggest that the capacity to decode, understand and regulate emotions is associated with social and emotional adaptation [16]. Studies have shown children who have difficulty regulating emotional reactions or impulsive behavior—because they are temperamentally over-reactive or lack emotional skills—are likely to experience difficulties in adapting to school, work and social environments [17]. Moreover, higher scores on emotional intelligence tests have been associated with various indicators of social adaptation, including more pro-social behavior among schoolchildren, greater empathy and fewer negative interactions with friends among college students [18,19].

However, the controversy about the importance of IQ and EQ is still very much alive. Witte [20] suggests that emotional intelligence has not greatly hampered the success of those who have superior intellectual capabilities, at least those who participated in their study. In a meta-analysis examining the correlation and predictive validity of EQ when compared to IQ or general mental ability, van Rooy and Viswesvaran [21] found IQ to be a better predictor of work and academic performance than EQ.

As mentioned earlier, dental fear and anxiety is a common occurrence, an essential and inevitable emotion that appears as a response to the stress induced by various dental procedures [2]. On the other hand, in some cases EQ and IQ are interconnected with

aspects of one's anxiety. Studies have found that a high level of EQ is able to decrease the level of anxiety of an individual [22]. Hodges and Plow [23] further showed that children with anxiety had a lower level of IQ than children without anxiety based on examination of the Full Scale IQ from the WISC-R. This implies that anxiety limits intellectual performance because an anxious child will have difficulty encoding and processing relevant and necessary information.

Although understanding the full extent of interplay between the IQ and EQ in behavioral outcomes is still far from achieved and that research often supports the notion that many decisions involve both cognitive and emotional processes [24], there are some significant questions that arise from a considerable body of previous research on the role of EQ and IQ in behavioral outcomes and emotional status in the dental setting. Based on the importance of EQ in social relationships and influence of IQ on behavior, it is plausible to postulate that IQ and EQ predict behavioral outcomes and emotional status in children. Thus, this research was built upon the growing understanding of the role of EQ and IQ in behavior of children with considering the additional anxiety factor. The aim of this study was to evaluate the impact of IQ and EQ on child's anxiety and behavior in the dental setting. We hypothesized that emotional intelligence and intelligence quotient play a role in child behavior and anxiety in the dental setting.

Materials and methods

Study population

The participants included 107 healthy children (54 boys and 53 girls) aged 7–12 years, enrolled in the Department of Pediatric Dentistry, Tabriz University of Medical Sciences, Tabriz, Iran, during the period from January–March 2010. The participants were mostly referrals from the general practitioners working in the area or children under routine medical care in the Pediatric Hospital, who are usually referred to the Department of Pediatric Dentistry for comprehensive assessments as well as routine dental treatments. Once admitted, children are examined by a post-graduate student under the supervision of a pediatric dentist. A comprehensive medical and dental history is then taken and a treatment plan is established for each patient.

The selected subjects were in complete physical and mental health, with no confounding medical history. The following criteria were considered for inclusion in the study:

- No history of post-traumatic stress disorders or specific phobia related to the dental settings;
- No history of unpleasant experiences in medical settings;

- No previous experience of intra-oral injections; and
- Having at least one decayed mandibular primary molar.

After preliminary selection of 267 subjects who matched the inclusion criteria of the study, a total of 107 random numbers were selected to include in the study.

The study procedure was explained to the parents and an informed written consent was taken. The study procedure was approved by the research and ethics committees of the Tabriz University of Medical Sciences.

Assessment instruments

The Bar-On emotional quotient inventory, youth version (EQ-i: YV). This inventory is a self-report measure of emotionally and socially intelligent behavior, which provides an estimate of one's underlying emotional and social intelligence [25]. It has 60 items which are distributed over six sub-scales (Intrapersonal Relationships, Interpersonal Relationships, Stress Management, Adaptability, General Mood and Positive Impression) and also provides a Total EQ score. Validation of the inventory on North American samples suggests that the Bar-On Emotional Quotient Inventory: Youth Version has excellent psychometric properties and identifies core features of emotional intelligence in children [26]. A standard score in the range of 90–110 indicates effective emotional and social functioning. A score greater than 110 suggests the presence of enhanced emotional and social skills, while a score of less than 90 suggests that emphasis should be placed on enriching skills in that area [27]. Responses were rated by the psychology postgraduate student on a 4-point scale ranging from 1 ('very seldom true of me') to 4 ('very often true of me'). Prior to the administration of the EQ-i: YV, translated version of the inventory to Farsi language was submitted to an expert psychologist for assessment. In the assessment of the items, attention was given to clarity, uniqueness, unambiguousness and the use of words with the exact meaning and equivalent to the English statements. The inventory was adjusted further on the basis of the comments from the expert. The translator was specifically requested to take care that the adaptation did not change the

purpose of the questions asked. The translated inventory was then back-translated by another translator, after which all items were checked again by the translator and same psychologist. To evaluate reliability of the questionnaire, a re-test correlation was significant, therefore indicating good reliability ($r = 0.83$; $p < 0.001$).

Raven's colored progressive matrices (Raven's CPM). Raven's CPM is probably the most well-known, most researched and most widely used of all culture-reduced tests. Its popularity is evident from the fact that it has been used in well over 1000 studies. The total score on the Raven's has proven to be a good measure of the general factor of intelligence. The reliability and validity of the test has been established across a range of populations (IQ, mean = 100 ± 15) [28,29].

Sound, eye and motor scale (SEM). The child's behavior was assessed during treatment using the sound, eye and motor scale designed by Wright et al. [30]. Classification of the SEM scale is presented in Table I. The subject's response was graded on a scale from 0–3, i.e. comfort, mild discomfort, moderately painful and painful, respectively.

Modified child dental anxiety scale (MCDAS). MCDAS is a measure of dental anxiety in children. It has an 8-question format, with a numeric rating scale ranging from 1 (relaxed/not worried) to 5 (very worried). Thus, the total score may range from 8–40. Sufficient evidence has been provided to justify the test reliability and validity [31].

Procedure

The study consisted of two consecutive sessions. The initial appointment consisted of complimentary dental examination followed by IQ and EQ evaluations and a fluoride therapy. Testing was conducted by two of the authors (NAA and ZEA) and a psychology postgraduate student. A package containing the EQ-i: YV and the Raven's CPM questions were given to subjects. After providing informed consent, test administrators explained to the respondents how to complete the inventory. All children were asked to

Table I. Description of SEM scale.

Parameter	Comfort (0)	Mild discomfort (1)	Moderate discomfort (2)	Discomfort (3)
Sound	None	Non-specific sound	Verbal complaint, louder sound	Verbal complaint, shouting, crying
Eye	No sign	Dilated eyes without tears	Tears, sudden eye movements	Crying, tears covering the face
Motor	Relaxed body & hand status	Muscular contraction & contraction of hands	Sudden body & hand movements	Hand movement for defense, turning the head to opposite side

complete the questionnaire by themselves with parents attending in a distance; however, those children who were unable to mark on the questionnaire were allowed to receive assistance from the supervising psychologist, who marked on the questionnaire on the child's behalf in such cases.

In view of the fact that the inventory may have given rise to questions and anxieties, test subjects were encouraged to make an appointment with the test administrators to discuss their feelings and the questions. Completion of the EQ-i: YV test took ~ 35 min.

Raven's CPM testing was conducted by the same administrators in a large examination hall with desks spaced well apart to prevent any interference from others. Three or four children were tested each time. To ensure the diligence with which participants approached their tasks, the instructions asked children to wait quietly at their desks if they finished before 30 min. The standard administration procedure as prescribed by Raven et al. was used for the original book form. As suggested by Raven et al. no time limit was assigned for either task. Participants were required to select a piece from six alternatives that completed the pattern for each item by marking on the answer sheet or, if unable to mark on the answer sheet, by asking for the supervisor and then pointing to their chosen response in the book form, in the case of which the supervising psychologist marked the child's answer in the answer sheet. Performance on the Raven's CPM was calculated according to the number of correct responses. Unmarked items were marked as incorrect.

A second appointment was scheduled for the restoration of decayed mandibular primary molar. After application of a topical anesthetic agent, inferior alveolar nerve block was injected slowly over a 1-min period using a short needle (length: 32 mm, gauge: 27). Under rubber dam isolation, a class II cavity was prepared using a high-speed hand piece and amalgam was placed and carved. A pediatric dentist who was blind to the results of the IQ and EQ tests assessed the child's behavior during operation according to the SEM scale. The subject's response was graded on a scale from 0–3, i.e. comfort, mild discomfort, moderate discomfort and discomfort, respectively. On a random basis ($n = 20$), a third experimenter along with the second experimenter performed the SEM evaluation using Cohen's kappa coefficient to provide a measure of rater reliability.

Results

Of the 107 children who completed the survey, seven subjects scored more than 10 in the inconsistency index for the EQ-i: YV, suggesting they responded randomly on the test and, therefore, were eliminated from further analysis. One hundred children (51 boys and 49 girls) with the mean (SD) age of 8.48 (1.41)

years old (range 7–12) were included in the statistical analyses.

The mean (SD) IQ score for all of the participants was 108.38 (18.59). The mean (SD) score of anxiety scale was 21.87 (6.06). The mean (SD) total EQ score of the participants was 102.78 (13.31). The lowest and highest EQ were 65 and 119, respectively (Table II). In this study, 16% of participants had a low EQ (<90), 55% had medium-level EQ (90–110) and 29% had a high EQ (>110).

The results of SEM observations revealed that on the SEM 37% of children were rated as having a 0 (comfort), 25% a 1 (mild discomfort), 21% a 2 (moderately painful) and 17% a 3 (painful).

To evaluate agreement between examiners on SEM, Cohen's Kappa was calculated and showed good agreements (0.79).

A multivariate correlation using Spearman's r revealed a significant negative correlation between SEM score and EQ total score ($r = -0.34$; $p < 0.01$) (Table III). Indeed, children with lower scores on the EQ scale had higher scores on the SEM scale which were indicative of the child's poor cooperation. However, there is no significant correlation between SEM and EQ sub-scale scores (Table II).

As can be seen in Table III, there was no correlation between IQ and SEM scores. A significant positive correlation was found between scores on the MCDAS and SEM ($r = 0.29$; $p < 0.01$) (Table III), which means that an increase in anxiety may result in poor cooperation during procedures.

Spearman's rho correlation analysis revealed that there was no significant relationship between EQ or IQ scores and anxiety as measured by the MCDAS (Table III).

Multivariate regression analysis

Table IV summarizes the results of the regression analysis. Entered/removed regression of the five variables including IQ, age, gender, anxiety and total EQ score, dental anxiety ($p < 0.01$), EQ total score

Table II. Descriptive values (mean, standard deviation, minimum, maximum) of age, EQ sub-scales, anxiety and IQ.

Variables	Mean	SD	Minimum	Maximum
EQ				
Intrapersonal scale	105.46	14.36	80	130
Interpersonal scale	101.40	14.30	65	120
Stress management	95.83	11.78	74	117
Adaptability	104.49	16.91	85	125
Total	102.78	13.31	65	119
Anxiety	21.87	6.06	8	37
IQ	108.38	18.59	68	146
Age	8.48	1.41	7	12

Table III. Spearman's Rho correlations between IQ, EQ, anxiety and age.

Variables	IQ	EQ	Anxiety	SEM	Age
IQ	$r = 1$	$r = 0.195^*$ $p = 0.026$	$r = -0.149$ $p = 0.70$	$r = -0.058$ $p = 0.282$	$r = -0.289^{**}$ $p = 0.002$
EQ	$r = 0.195^*$ $p = 0.026$	$r = 1$	$r = -0.088$ $p = 0.193$	$r = 0.342^{**}$ $p = 0.000$	$r = -0.006$ $p = 0.477$
Anxiety	$r = -0.149$ $p = 0.70$	$r = -0.088$ $p = 0.193$	$r = 1$	$r = 0.297^{**}$ $p = 0.001$	$r = 0.059$ $p = 0.279$
SEM	$r = -0.058$ $p = 0.282$	$r = -0.342^{**}$ $p = 0.000$	$r = 0.297^{**}$ $p = 0.001$	$r = 1$	$r = -0.117$ $p = 0.123$
Age	$r = -0.289^{**}$ $p = 0.002$	$r = -0.006$ $p = 0.477$	$r = 0.059$ $p = 0.279$	$r = -0.117$ $p = 0.123$	$r = 1$

*Correlation is significant at $p < 0.05$; **Correlation is significant at $p < 0.01$.

($p < 0.01$) were found to be significant predictors of the child's behavior during treatment on the SEM score ($r^2 = 0.228$).

Discussion

The present research was designed to explore the impact of IQ and EQ on child behavior and their relation with anxiety in the dental setting. To the best of our knowledge, this is the first study to evaluate these relationships. The results showed a significant negative correlation between children's behavior and total EQ score, but there was no relationship found between children's behavior and IQ score. A significant positive correlation was found between anxiety scores on the MCDAS and SEM scales, but no relationship was found between EQ and MCDAS scores.

The results of this study revealed two main findings that provided support for the incremental validity of EQ in predicting children's behaviors. First, consistent with our hypothesis, we found a strong relationship between overall EQ score and children's behavior during dental treatment. Moreover, the results of regression analysis also highlights the critical role of the child's EQ score compared to that of anxiety score as measured by the MCDAS. In fact, the results of this study suggest that those who are more emotionally perceptive or have greater levels of emotional

intelligence may actually be less affected by stress and may exhibit better positive interaction and cooperation. This view is in line with conclusions drawn from previous studies [14,15,32]. Emotional intelligence may actually serve to buffer and protect against negative life events and help in psychological adjustment and coping ability of children by reducing stress and improving health, well-being and performance [33]. This notion may also lend support to newer research focusing on the importance of emotional competence in relation to adjustment and satisfaction in life [14,15].

Researches have shown that if children have the capacity to understand, communicate and regulate their emotions, they can then respond to stresses in socially appropriate, flexible and adaptive ways. The present results are consistent with these researches indicating a significant relationship between EQ score and child behavior (SEM) [34]. In this study, there was no statistically significant relationship found between EQ and dental anxiety, but previous studies have shown inverse relationship between emotional intelligence and anxiety [7,22,35].

The present results are consistent with those indicating an absence of significant relationship between IQ score and child behavior (SEM) or IQ score and anxiety (MCDAS). In agreement with our results, a 3-year follow-up study conducted on the Kroger sample revealed no evidence of a correlation between

Table IV. Results from multivariate regression analysis predicting SEM from IQ, anxiety and EQ.

Predictor	Unstandardized coefficients		Standardized coefficients Beta	<i>t</i>	<i>p</i>
	B	Std. Error			
Constant	0.710	0.433		1.637	0.105
Anxiety	0.050	0.017	0.270	2.948	0.004
EQ	-0.549	0.156	-0.323	-3.528	0.001

Dependent variable: SEM.

IQ and total anxiety [36]. It has been suggested that IQ largely reflects a broad neuropsychological function, known as 'executive functioning' that includes sustaining attention and concentration, reasoning abstractly, forming goals, anticipating and planning, initiating purposeful behavior and self-monitoring. Executive control deficits interfere with a person's ability to monitor and control their own behavior [37,38]. In general, there is little evidence of a strong relationship between IQ and anxiety. However, excessive anxiety may be related to deficits in specific areas of cognitive functioning, such as memory, attention and speech or language [39].

We also observed that there was a significant relationship between anxiety and the children's behavior in the dental setting. Those children who were more anxious showed more problematic behaviors than those who were not. Studies established that children's anxiety could be predictive of their behavior in dental settings [40]; anxiety is a response to a perceived threat resulting in fear and avoidance behaviors. Anxiety could also become a possible impediment to the learning process [22,23,41], which in turn leads to weakening of cognitive functioning, including memory, formations of concepts and problem-solving [22]. The results of this study are consistent with other published reports of disruptive behaviors related to anxiety [39].

A major limitation in studying IQ and EQ is that for two-by-two comparison of child behavior in low, medium and high levels of IQ and EQ, which results in nine groups, a fairly large sample would be needed. The samples of the present study did not allow for statistical analysis of such groups as, for example, there is only one subject in the low IQ-EQ group. Therefore, further studies involving a larger sample size are necessary.

Another major concern in the present study is an inherent limitation to EQ evaluation tools, which does not allow for utilizing such measures under the age of 6, due to the abstract nature of the emotional intelligence, whereas delinquent behavioral cooperation in the dental setting is frequently seen in this age range. Although the assessment of IQ in children under the age of 6 is possible, the lack of a feasible method for evaluation of emotional intelligence in this age range severely limits similar study designs in a younger age group (<6 years old).

The results of our study could develop a theoretical justification for the notion that individuals with high EQ may be more effective in managing change than individuals with low EQ in dental setting. Moreover, these findings support the notion that EQ scores were far more related to the child's performance on a routine dental care than IQ.

Overall, the results of this study, based on cognitive-affective function of mental life, consider the practical implications to these elements. Thus,

early identification of intellectual abilities could allow for the possibility of early interventions that could potentially shift children away from the emergence of some behavioral problems and, therefore, may help in building an intelligence-based management approach of children's behavior during dental treatments.

Then efforts could be made to enhance or modify a child's EQ due to its potentially-strong moderating effect on child behavior. As future research proceeds, it will be needed to develop emotionally-based behavioral management strategies which are suited to take advantage of emotion-related regulation.

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