

When the fear of dentist is relevant for more than one's oral health. A structural equation model of dental fear, self-esteem, oral-health-related well-being, and general well-being

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Purpose: To develop and test a complex model that captures the individuals' general well-being and the specific oral-health-related well-being. We were specifically interested, as a specific research question, if self-esteem, dental fear, and the oral health-related well-being are credible predictors for the general well-being.

Patients and methods: A one-time associative research design measured dental-specific anxiety, self-esteem, oral-health-related specific well-being, and general well-being in 281 participants, 3rd and 6th year dental students ($M_{Age} = 22.59$ years, $SD_{Age} = 3.13$; 55% females), which completed a battery of relevant questionnaires: the Dental Fear Survey, the Rosenberg Self-Image Scale, the short form of Oral Health Impact Profile, and the Flourishing Scale. The data were subject to structural equation modeling in order to validate potential pathways of influence hypothesized based on previous evidence from the literature.

Results: We developed and tested a complex structural equations model, in which dental fear influences both the specific oral-health-related well-being and the persons' self-esteem. In turn, self-esteem mediates the influence pathways between dental fear and oral-health-specific well-being, on the one hand, and the overall well-being, on the other hand.

Conclusion: Our research contributes directly to strengthening the theoretical basis for future interdisciplinary research, by providing, first, a tested and replicable model that surpasses the simple correlation or prediction, and second, empirical evidence for the significant mutual interdependence between psychological experiences, eg, self-esteem, and the two main aspects of well-being, ie, specific and general. From a practical, clinical viewpoint, our research provides further insights and justification for the importance of educating the patient, on all levels, from the individual clinical practice to community programs and public oral health policies, with respect to the importance of oral health.

Keywords: oral health, well-being, quality of life, self-esteem, anxiety, mediation, structural equation modeling

Introduction

The importance of oral health for the person's general health was shown repeatedly in existing studies.^{1,2} On the one hand, oral pathology is often associated with many other medical conditions, ranging from other severe oral pathologies³ to diverse pathologies such as diabetes,⁴ heart conditions,⁵ kidney disease,⁶ or even affecting pregnancy.⁷ On the other hand, it impacts a huge variety of life segments, ranging from the youngest⁸ to the eldest.⁹

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The increasing interest for the implications of oral health was paralleled by the emergence of the new field of oral-health-related quality of life.¹⁰ WHO defines oral-health-related quality of life (OHRQoL) as the individual's perceived impact of pain, discomfort, and physical, psychological, and social functioning over the individual's well-being.¹¹ However, as Slate¹² observes, "[the] concepts of *health* and *quality of life* are elusive and abstract; while we know intuitively what they mean, they are difficult to define" (p. 12), which further complicates the analysis of the relationship between the quality of life and oral health.

Originally, the perspective regarding general health included broad, categorical factors of influence – ie, of economic, environmental, and behavioral nature.¹³ Nevertheless, the complexity of this perspective increased over the years and it now includes biological, social, and psychological factors.^{14–16} Recent research has provided empirical evidence that oral health is significantly and positively associated with both general health status and mental health status.¹⁷

According to Gluck and Morganstein,¹⁸ maintaining a good oral health in relation with the entire healthy self is important because being healthy means more than not having a medical condition. Yet, in the case of oral health, preventive measures have not been implemented to their fullest potential, even though relatively small investments would yield lifelong benefits".¹⁸ Moreover, according to Harnagea et al's¹⁹ review regarding the integration of oral health in primary care, "despite its importance, the integration of oral health into primary care is still an emerging practice in the field of health care services".¹⁹

With respect to oral health, the individual oral health impact on their quality of life as well as and the societal impact in terms of preventive and curative actions, programs and policies are significant. This paper is concerned with the relation between the oral-health-related well-being and the general well-being of the person, in the context of other, person-specific constructs (ie, dental fear and self-esteem), capable of explaining some of the complexities of this relationship.

Theoretical background

Oral health, quality of life, and well-being

Significant association was found between the quality of life and general oral health,^{20,21} and also between the quality of life and specific oral health conditions. For instance, examples relevant for the quality of life include malocclusions and orthodontic therapy,^{22–24} periodontitis,²⁵ dental implants,²⁶ removable dental prosthesis,²⁷ or edentulism.²⁸

With respect to the quality of life, Drummond, Meldrum, Boyd²⁹ found that dental problems in early childhood can have a very significant effect not only on the oral health of young children but on their quality of life and that of their families. Added to this are the long-term risks they carry into the permanent dentition.²⁹

Further studies found that oral health in children was positively associated with the social and emotional well-being, mental health, and family functioning.³⁰ Other studies, targeting a specific pathology, found that in adolescents with malocclusion, this specific oral condition impacted negatively the quality of life, with the emotional and social well-being components being the most affected.³¹

In the same vein, Isola et al³² found strong association of temporomandibular joint arthritis (TMJ) arthritis with juvenile idiopathic arthritis (JIA) duration and activity, and that TMJ is associated with higher functional disability and lower oral-health-related quality of life in patients with JIA than in those unaffected by JIA.

However, it is important to note that children and adolescents are not the only ones who's general well-being is affected by oral health. In a study that included individuals over 75 years old, Brennan and colleagues³³ found oral health to be important, alongside general health, living conditions, and dependency.

Oral health, quality of life, and self-esteem

The relationship between oral health and self-esteem is heavily featured in the literature. A plethora of studies show a positive association between self-esteem and oral health. A variety of oral pathologies, including malocclusions, anterior traumatic tooth, tooth loss, and untreated decay affect self-esteem because of their impact on the esthetics and psychosocial functioning.³⁴ Self-esteem was also found to be negatively associated with negative affect and with poorer OHRQoL,^{35,36} and with lower levels of OHRQoL.³⁷ Additionally, self-esteem was found to be positively associated with school academic performance,³⁸ and negatively with specific mental disorders, such as alcoholism.³⁹

The importance of self-esteem as an associated psychological construct is also highlighted in studies which take a more psychological approach to the individual's oral-health-related behaviors. Dumitrescu, Zetu, Teslaru⁴⁰ found that self-esteem can be successfully modeled as a predictor for oral-health-related behaviors, along other self-constructs, such as self-confidence, self-competence, self-liking, self-control and perfectionism.⁴⁰ Other studies interested in the

association between self-esteem and oral-health-related behaviors found similar, positive association.⁴¹

Moreover, while dental treatment in children, such as orthodontic therapy, may be associated with a deterioration of the overall perceived oral-health-related quality of life, self-esteem was found to moderate “protectively” the impact of treatment,⁴² and the resulted improvement in oral health can lead to improvements in self-esteem.⁴³ Both the perceived, self-rated general health and the oral-health-related oral health were shown to effect positively on the self-esteem and on *life-satisfaction*.⁴⁴

Oral health, quality of life, and dental fear

Dental anxiety was found to accentuate the impact of dental pain on the individuals, which, in turn, was associated with poor OHRQoL, in both adults⁴⁵ and children.⁴⁶ Perhaps not coincidentally, considering the often coexistence of pain and poor oral health status, dental anxiety is positively associated with avoiding concrete dental work and dentist appointments, which in turn, positively predicts poor levels of oral health.⁴⁷ However, direct, unmediated connections between the dental fear and oral-health-related quality of life were also found in both adults^{48,49} and children.⁵⁰

A recent research by Costa et al⁵¹ have found that general anxiety symptoms have a direct effect on oral health perception in young women, not mediated by specific dental anxiety. With respect to specific pathologies, the presence of chronic periodontitis is associated with both high levels of dental anxiety and with lower levels of OHRQoL.^{52,53}

In relation with the overall quality of life, a study concerned with the evaluation of dental fear and anxiety in displaced persons in Bosnia and Herzegovina⁵⁴ provided empirical evidence that vulnerable individuals are more prone to higher levels of dental fear, poor oral health status, rarer visits to the dentist, and urgent need for dental treatment, and concluded that bad oral health and dental fear may be reciprocally influencing each other.⁵⁴ Vulnerable groups, such as people with mental disorders, are also more susceptible to poorer oral health whilst having to deal with increased dental fear, poorer coping strategies, and other economic and social challenges.⁵⁵

Notwithstanding well-identified vulnerable groups, the presence of dental fear, along with sociodemographic difficulties and behavior management problems, were found to be indicative for dental health problems, ie, poor oral health.⁵⁶ For instance, Chow and Cioffi⁵⁷ found significant associations between increased activation of oral behaviors

and trait anxiety, on the one hand, and the self-reporting of temporomandibular disorders on the other hand. However, there is also scientific evidence that good communication with the dentist attenuates the fear of dentist and is positively associated with higher levels of oral health literacy.⁵⁸ In addition, cognitive behavioral therapy was found to be effective in reducing dental anxiety in young patients.⁵⁹

Rationale of the research and research questions

While the studies reviewed above depicting a clear picture of association between oral health, as a central construct, and other related variables, what they lack is a concrete, theoretically based conceptualization of the relationship between the variables of interest. More specifically, while some studies treat oral health as the outcome variable,³⁰ others do precisely the opposite, and operationalize it as the predictor variable.³¹ Finally, there are also studies that warn about mechanisms of mutual influence.⁵⁴

The complex and potentially reciprocal mechanism of influence between oral health and self-esteem is apparent when considering the research of studies that operationalized self-esteem as the outcome variable. For instance, Sano-Asahito, Suzuki, Matsuyama, Mitomi, Kinoshita-Kawano, Hayashi-Sakai, Asahito⁶⁰ found that dental interventions – ie, with the specific outcome of improving oral health, can be effectively employed to improve the self-esteem of abused children.⁶⁰ Other researches are even more precise in asking for further investigation regarding the mechanisms through which self-esteem impacts on OHRQoL.³⁷

Another characteristic of the studies reviewed above is that their participants were predominantly children or adolescents or people with specific oral pathologies, ie, mostly convenience samples. While convenience samples can be purposive, and they are often justified because of logistical reasons in real-life, or specific reasons pertaining to ecological research, they sometimes miss important segments of the population.

One noteworthy finding during our literature review was that the relation between self-esteem and dental fear is one much less investigated in the literature. While hundreds of peer-reviewed articles tackle the relation between oral health and self-esteem, our search identified only a few peer-reviewed articles that included analysis of the relation between dental-fear and self-esteem or related constructs, such a self-consciousness.

Currently, significant gaps still persist with respect to the conceptualization of all the above constructs within a coherent model, or, more specifically, for instance, the placement and the role of the relation between dental fear and self-esteem. Based on the studies reviewed above, we hypothesized that a complex model comprising dental fear, oral-health-related well-being, self-esteem, and general well-being could explain more of the inter-relationships between these four important constructs than mere one-to-one correlational studies.

Given the relationships overviewed above, we were interested, as a general research question, if these biunivocal relationships, taken together, can provide a more comprehensive picture of their overall relationship. Within this general interest for conceptualization of all four main constructs taken together, we were specifically interested, as a specific research question, if self-esteem, dental fear, and the oral-health-related well-being are credible predictors for general well-being.

Materials and methods

Research design and data analysis

In order to accommodate our research questions, we used a cross-sectional, associative research design, in which dental (specific) fear, oral-health (specific) well-being, and self-esteem were operationalized as predictor variables and general well-being was treated as the outcome variable.

Our statistical method of choice was structural equation modeling (SEM) because it is capable of dealing with multiple theoretical models, including regression models, pathway models, and confirmatory factor analysis (CFA), and, additionally, it can suggest new mechanisms of influence that were previously unthought of.⁶¹

In this approach, the explanatory, or predictor, variables are considered exogenous and the explained, predicted variable is considered endogenous, with the caveat that, in complex models, some exogenous variables can also be viewed as endogenous if other variables act upon them as predictors.

Measures

All measures used in this research were self-reported questionnaires constructed as 4, 5, or 7-step Likert Scales and are presented in extenso in Appendix.

Specific, oral health-related well-being

This major construct was assessed using the “Oral Health Impact Profile” (OHIP-14), a short, 14-item translated and

adapted version⁶² of Gary Slade’s⁶³ scale for assessing the impact of oral health on subjective well-being. The items in OHIP-14 were directly formulated and scored on a 5-step Likert scale (1= “not at all” to 5= “fairly often”). The internal validity of the original 14-item version, measured as Cronbach’s alpha, was 0.88. While the Romanian version, used here, assumed 7 postulated underlying factors: a) functional limitation, b) physical pain, c) psychological discomfort, d) physical disability, e) psychological disability, f) social disability, and g) handicap,⁶² other research found the underlying factor structure to vary from 2 to 3 and even to a 4-factor structure.⁶⁴

Self-esteem

In our research, self-esteem (SES) was assessed using the “Rosenberg Self-Image Scale”,⁶⁵ which contained 10 items (5 were inverted), measured on a 4-step Likert Scale, ranging from 1, “strongly disagree”, to 4, “strongly agree”. Half of the items were reversely formulated and were originally assumed to specify a single underlying construct. However, while extant-related research also showed acceptable to good psychometric properties and cross-cultural validity,^{66–68} some of them also raised significant methodological questions as to the unidimensionality of the construct and the factor structure was sometimes found to be bi-dimensional, with reversed items factoring separately from the directly formulated items, especially in non-English participants.^{69–71}

Dental anxiety

We used the “Dental Fear Survey” (DFS) developed by Kleinknecht et al⁷². While the original scale had 27 items, a follow-up factor analysis and validation reduced it to 20 items, scoring on a 5-step Likert scale, and measuring three underlying factors, ie, a) avoidance of dentistry, b) felt autonomic arousal during dentistry, and c) fear of situation and stimuli.⁷³ Consequent research mainly supported the originally posited 3-factor structure, confirmed good to very good internal consistency and showed good cross-cultural validity,^{74–76} albeit not always the same as the original.⁷⁷

General well-being

This construct was measured using the “Flourishing Scale” (FLS), an 8-item measure of general well-being formulated as a 7-step Likert scale conceived and validated as being unidimensional.⁷⁸ Other research using extensive samples of Portuguese, Indian, Chinese, and French

cultural backgrounds provided strong evidence for its good internal consistency and cross-cultural validity.^{79–82}

Proposed conceptual model and associated hypotheses

Our conceptualization of the relationships between the four main constructs of interest presumes the existence of four latent factors, one for each main construct. Specifically, in our model, oral-health-related well-being, dental fear, and self-esteem, predicted general well-being. As our review of existing research showed, there is no clear consensus as to the directions of influence between any of the biunivocal pair of predictors.

Therefore, our model development was guided by dogmatic and logical assumptions rather than by existing consolidated theories. Specifically, we conceptualized that it is conceivable that an increase in fear of dentist, ie, dental fear, reflects in a decrease in self-esteem, and, concomitantly, it also leads to a less proactive attitude toward using self-care or specialized dental services, and, thus, subsequently, to a lower oral-health-related well-being. In turn, a deterioration in oral-health-related well-being would, conceivably, lead to lower self-esteem. Finally, we theorized that the self-esteem is negatively associated with general well-being.

In addition to the relationships conceptualized above, we needed to account for the mediating role of self-esteem, between dental fear and oral-health-related well-being, on the one hand, as predictors, and general well-being, as the outcome variable (see Figure 1, for the proposed model). As a direct consequence, our working hypotheses corresponded to every biunivocal relationship depicted in the proposed model.

Procedure and data analysis

The study was conducted under the ethical provisions of the decision 496/09.02.2016 of the Ethical Board of Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania, and observed all ethical guidelines of the decision. Participation in the study was voluntary and accepted based on informed written consent and withdrawal from the study was announced and possible at any time.

Data collection was made via paper and pencil questionnaires, which were distributed, completed, and collected during a school session and by using a Google Form. The collected data were processed using IBM™ SPSS (IBM, 2016) version 24, and IBM AMOSTM.⁸³ To ensure transparency and replicability,

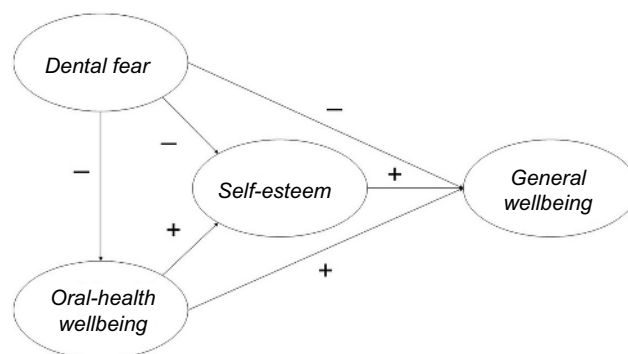


Figure 1 Conceptual model of the relationships between the general perceived well-being as the outcome variable and the oral-specific well-being, dental-specific anxiety, and self-esteem, as the predictor variables (the arrows represent the hypothesized directions of influence and the plus/minus sign designates the positive/negative association).

Notes: In our model, the potentially counterintuitive positive association between dental fear and oral-health-related well-being is due to the fact that oral-health well-being was a reverted measure, estimated by the severity of the health conditions, which transformed it into a measure of discomfort. This aspect is made clearer in the final outputs of the structural equation models.

almost all computations were replicated using the R Statistical Computing Software.⁸⁴

Participants

The research used a purposive, convenience research sample, totaling 281 persons, students of the University of Medicine and Pharmacy. The mean age of our sample was $M_{Age} = 22.59$ years, standard deviation $SD_{Age} = 3.13$; 154 (55%) participants were females, $M_{Age\ Females} = 22.67$, $SD_{Age\ Females} = 2.62$, whereas 127 (45%) were males, $M_{Age\ Males} = 22.50$, $SD_{Age\ Males} = 3.66$.

Results

Data analysis and preprocessing

The collected data were subject to a preprocessing procedure consisting in cleaning and preparation (eg, coding, reversing inverted/negatively formulated items, missing cases, and outlier analyses) for specific data analyses. After preprocessing, an exploratory factor analysis (EFA) was performed and a final pathway model was developed.

The preliminary analysis showed 50 cases of missing data points. Their number was well under the commonly used 5% threshold for variable of vector imputation while the Little's MCAR test indicated these were distributed at random.⁸⁵ Consequently, they were imputed using the multivariate imputation by chained equation method used by the MICE R package.⁸⁶ Additionally, the multivariate outlier's analysis using the Mahalanobis distance identified 34 cases of outliers which were removed from further analyses.

Exploratory factory analysis

Both the Bartlett's^{87,88} test (*Chi-square* =1298, *p*=0.32, and *df*=1275) and the Kaiser-Meyer-Olkin's^{89,90} test (with an MSA of 0.92) indicated a good adequacy of the data for EFA.

A first EFA with Maximum Likelihood (ML) rotation, conducted in SPSS, indicated 9 factors based on eigenvalues greater than 1, while its correspondent parallel analysis conducted in R⁸⁴ using Dinno's⁹¹ "paran" package also indicated 9 components. However, the EFA with ML using the "psych" package,⁹² indicated a 4-components and 4-factors solution.

In this regard, it is important to note that there is evidence that EFA conducted on Likert scales' items tend to produce an overinflated number of factors.^{93,94} Forcing a four-factor solution was satisfactory both in R and in SPSS but achieving satisfactory fit required discarding several items which did not load satisfactory on their respective parent constructs (see Table 1 for the list of complete and discarded items). This solution explained 51.86% of the variance in data (see Table 2 for the items' loadings and factors' separation).

Hypotheses (pathways) testing

Four out of six five hypotheses (directions of influence) resulted as valid after CFAs, and, most importantly, the entire proposed conceptual model held after CFA (see Figure 2, for the final pathway model). Only two proposed pathways, between dental fear and general well-being, and between oral-health-related well-being and general well-being, resulted as non-significant. From a methodological perspective, this confirmed the role of self-esteem as perfect mediator between dental fear and oral-health-related well-being, on the one hand, and general well-being, on the other hand.

The resulted final model presented good to very good fit indices (*CFI* =0.93, *CMIN* =1529.393, *DF*=875, *SRMR*=0.054, *RMSEA*=0.052, *PCLOSE* =0.257), as well as very good construct validity and reliability, as shown in Table 3 and Table 4.

Discussion

Interpretation of the findings in context

We employed measurements that were widely used and validated in previous research, which facilitates both the

Table 1 Scales' items

Scale	Item Code	Item
DFS	DFS_01_DTA*	To put off making any appointment?
	DFS_02_DTA	To cancel or not appear for an appointment?
	DFS_03_PA	My muscles become tense
	DFS_04_PA	My breathing rate increases ...
	DFS_05_PA	I perspire
	DFS_06_PA*	I feel nauseated and sick to my stomach
	DFS_07_PA	My heart beats faster
	DFS_08_DTA	Making an appointment for dentistry
	DFS_09_DTA	Approaching the dentist's office
	DFS_10_DTA	Sitting in the waiting room
	DFS_11_DTA	Being seated in the dental chair
	DFS_12_DTA	The smell of the dentist's office
	DFS_13_DTA	Seeing the dentist walk in
	DFS_14_FR	Seeing the anesthetic needle
	DFS_15_FR	Feeling the needle injected
	DFS_16_FR	Seeing the drill
	DFS_17_FR	Hearing the drill
	DFS_18_FR	Feeling the vibrations of the drill
	DFS_19_FR*	Having your teeth cleaned
	DFS_20_DTA	All things considered, how fearful are you of having dental work done
FLS	FLS_01	I lead a purposeful and meaningful life
	FLS_02	My social relationships are supportive and rewarding
	FLS_03	I am engaged and interested in my daily activities
	FLS_04	I actively contribute to the happiness and well-being of others
	FLS_05	I am competent and capable in the activities that are important to me
	FLS_06	I am a good person and live a good life
	FLS_07	I am optimistic about my future
	FLS_08	People respect me
OHIP	OHIP_01_FL*	Trouble with pronunciation
	OHIP_02_FL*	Worsened sense of taste
	OHIP_03_PhP*	Painful aching in the mouth
	OHIP_04_PhP*	Discomfort while eating
	OHIP_05_PsDc	Feeling self-conscious
	OHIP_06_PsDc	Feeling tense
	OHIP_07_PhDb	Unsatisfactory diet
	OHIP_08_PhDb	Interrupted meals
	OHIP_09_PsDb	Difficult to relax
	OHIP_10_PsDb	Being embarrassed
	OHIP_11_SDb	Being irritable
	OHIP_12_SDb	Difficult to do usual jobs
	OHIP_13_HC	Life less satisfying
	OHIP_14_HC	Inability to function at all

(Continued)

Table 1 (Continued).

Scale	Item Code	Item
SES	SES_01_D	I feel that I am a person of worth, at least on an equal basis with others.
	SES_02_D	I feel that I have a number of good qualities.
	SES_03_R	I really feel that I am a failure.
	SES_04_D	I am able to do things as well as most other people.
	SES_05_R	I do not have much to be proud of.
	SES_06_D	I take a positive attitude toward myself
	SES_07_D	On the whole, I am satisfied with myself.
	SES_08_R*	I wish I could have more respect for myself.
	SES_09_R	I certainly feel useless at times.
	SES_10_R	At times I think I am no good at all.

Note: The asterisk (“**”) indicates items discarded following the EFA. **Abbreviations:** SES, self-esteem; DFS, Dental Fear Survey; OHIP, Oral Health Impact Profile; FLS, Flourishing Scale; EFA, exploratory factor analysis.

reproduction of the research and the interpretation of our model and results in relation with existing research. Moreover, whereas existing research is dominated by the extensive use of children and adolescents as participants and/or participants with specific oral pathology, our participants’ sample was made up of both non-clinical participants and young adults.

In a nutshell, the relation between general and specific in oral health is rather important, considering that an explained variance of approximately 54% in general well-being was explained by our model. However, what is even more substantive and relevant is that the relation between the dental-specific well-being and the general well-being is mediated perfectly by the self-esteem. Thus, our findings suggest that self-esteem “takes a first hit” when the person’s dental-specific well-being is affected and remains as the single significant explanatory factor for the general well-being.

Limitations

The biggest limitation that affects all models developed using structural equation is their intrinsic lack of power regarding the direction of influence or causality. In our model, we hypothesized certain directions of influence, but for every intent and purpose, these directions should be interpreted as predictions and not as causal pathways. For instance, we hypothesized that dental fear is negatively associated with self-esteem, which

Table 2 Item loadings

Item	DFS	OHIP	SES	FLS
DFS_02_DTA	0.59			
DFS_03_PA	0.62			
DFS_04_PA	0.66			
DFS_05_PA	0.62			
DFS_07_PA	0.75			
DFS_08_DTA	0.89			
DFS_09_DTA	0.86			
DFS_10_DTA	0.83			
DFS_11_DTA	0.91			
DFS_12_DTA	0.66			
DFS_13_DTA	0.75			
DFS_14_FR	0.73			
DFS_15_FR	0.74			
DFS_16_FR	0.85			
DFS_17_FR	0.85			
DFS_18_FR	0.79			
DFS_20_DTA	0.82			
OHIP_05_PsDc		0.68		
OHIP_06_PsDc		0.73		
OHIP_07_PhDb		0.70		
OHIP_08_PhDb		0.69		
OHIP_09_PsDb		0.76		
OHIP_10_PsDb		0.76		
OHIP_11_SDb		0.75		
OHIP_12_SDb		0.76		
OHIP_13_HC		0.78		
OHIP_14_HC		0.70		
FLS_01			0.63	
FLS_02			0.69	
FLS_03			0.56	
FLS_04			0.69	
FLS_05			0.79	
FLS_06			0.86	
FLS_07			0.76	
FLS_08			0.72	
SES_01_D				0.63
SES_02_D				0.79
SES_03_R				0.65
SES_04_D				0.53
SES_05_R				0.66
SES_06_D				0.74
SES_07_D				0.68
SES_09_R				0.61
SES_10_R				0.55

Abbreviations: SES, self-esteem; DFS, Dental Fear Survey; OHIP, Oral Health Impact Profile; FLS, Flourishing Scale.

our findings confirmed. However, it would be a mistake to conclude, based on this research’s results alone, that by decreasing the dental fear, the individuals will experience, as an effect, higher levels of self-esteem.

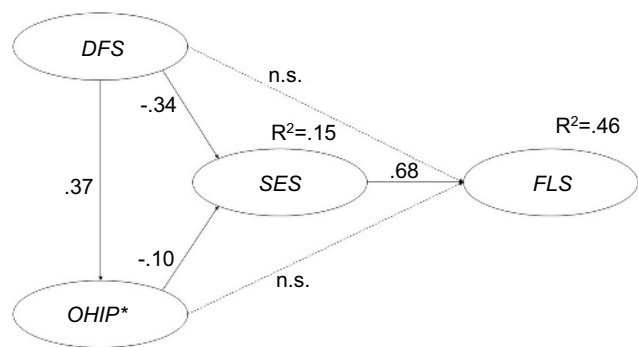


Figure 2 Final pathway model of the relationships between the general perceived well-being as the outcome variable and the oral-specific well-being, dental-specific anxiety, and self-esteem, as the predictor variables (the dotted pathways marked "n.s." indicate nonsignificant relationships).

Note: The positive association between dental fear and oral-health-related well-being, and the negative association between oral-health-related well-being and self-esteem is due to the fact that the oral-health-related well-being was measured via the severity of the oral health conditions, which made it a measure of discomfort.

Abbreviations: SES, self-esteem; DFS, Dental Fear Survey; OHIP, Oral Health Impact Profile; FLS, Flourishing Scale.

Another issue that may be viewed as a limitation in our model is the factor structure of the developed model. It is important to note, in relation with our decision to keep in our model factor structures different than the originals reported, that a 2-item factor structure is not recommended in SEM,⁹⁵ for reasons mainly pertaining to the identification of the model during CFA.^{96,97} It is also worth observing that those instances in which we accepted a 2-factor structure was not for dogmatic reasons but only for methodological reasons, guided and justified by the EFA and CFA. While this may not be widely regarded as a significant limitation, the above mention is important because of its relevance for potential future attempts to reproduce or analyze some of our constructs' structure.

A third limitation with respect to our choice of statistical methods is related to the number of potential

predictors. Due to the mathematical way of calculating the total explained variance (R^2), as the ration between the explained sum of squares and the total sum of squares, increasing the number of explanatory variables in the model will always lead to an increase in R^2 for the outcome variable. However, this leads to a delicate question for the researchers, who must decide what explanatory variables to keep and what to exclude, while still arriving at a satisfactory and adequate final explained variance.

Finally, a limitation worth noting related to our sample of participants. It is reasonable to assume that dental students are more accustomed and more educated with respect to dental interventions than the vast majority of the population. Therefore, this type of participants may have exhibited a specific bias in the way of expressing lower levels of dental fear than the average population. It is possible, therefore, that the strength of association between dental fear and the other three constructs be slightly different in the overall population, in which we would expect a higher variability of the dental fear. However, this was an aspect that our research design could not cover and can be investigated by future research.

In our research, the lack of theoretical foundation limited our quest in identifying potential explanatory variables to those that were indicated in previous studies, such as the self-esteem. Thus, we refrained from including other variables only on speculative bases, albeit potentially logically justified, because it would have diluted the significance of our results and because it would have taken our research on exploratory grounds that were not part of our initial research goals.

Along the same lines of deciding which theoretical/proposed constructs deserve inclusion in a model, also

Table 3 Construct validity and reliability

Construct	CR	AVE	MSV	MaxR(H)	SES	DFS	OHIP	FLS
SES	0.886	0.467	0.444	0.905	0.683			
DFS	0.958	0.579	0.137	0.967	-0.364	0.761		
OHIP	0.914	0.518	0.137	0.919	-0.240	0.370	0.720	
FLS	0.918	0.586	0.444	0.925	0.666	-0.281	-0.101	0.765

Abbreviations: SES, self-esteem; DFS, Dental Fear Survey; OHIP, Oral Health Impact Profile; FLS, Flourishing Scale.

Table 4 Fit indices for the pathway model

Model	CMIN	DF	SRMR	CFI	RMSEA	L090	HI90	PCLOSE
Default	1529.393	875	0.054	0.928	0.052	0.047	0.056	0.257

Note: CMIN = Chi-square value, DF = degrees of freedom, SRMR = standardized root mean residual, CFI = Comparative Fit Index, RMSEA = root mean square error of approximation, LO90 = lower bound of the Confidence Interval for RMSEA, HI90 = higher bound of the Confidence Interval for RMSEA, PCLOSE = p of close fit.

lies the conceptualization of our main constructs as second-order constructs. While it may be regarded as a limitation, in the sense of a comprehensive coverage of developing all possible models, we believe that this lack is justified in our research for several reasons. First, our main and foremost interest was to observe a feasible way in which the main constructs relate with each other. Second, refining the constructs and feasibly testing second-order structures would have required a larger and more diverse sample than ours.

Implications for theory and practice and future directions

Our model needed to allow for the possibility of testing the dental fear and oral health as direct predictors for the general well-being, concomitantly with their mediated relations. Our findings provide additional factual evidence for the need for better oral health prevention programs and for specific instruction in both the use of dental care services and for self-care practices. Physicians and health policy makers, alike, could use this supplementary evidence with respect to the major role that self-esteem plays in association with both oral health-related well-being and general well-being. Starting with detailed explanations about the treatment and adequate bed-side manners, to understand the impact on the life of the individuals, efforts are both needed and welcomed to include and consider the impact of the patients' self-esteem.

Moreover, dental fear, a form of specific anxiety, impacted both self-esteem and the oral-health-related well-being. Thus, it is a factor that should be considered in all forms of contacts between the patient and the dental care system. While it can be argued logically that being less afraid of the dentist is conducive to a more compliant attitude of the potential patient, our findings provide concrete evidence that improved dental-specific well-being and self-esteem are, indeed, associated with lesser specific anxiety. As Dumitrescu, Zetu, and Teslaru⁴⁰ recommended

[u]nderstanding the psychological factors associated with oral hygiene can further the development and improvement in therapeutic strategies to be used in oral health-improving programs, as well as of programs aimed at prevention and education.⁴⁰

In this specific regard, recent research by Chow and Cioffi⁵⁷ provided substantial evidence that oral behaviors having the potential to contribute to the onset of temporomandibular

disorders should be considered when developing complex models of oral health impact and well-being.

One oddity that appeared in our final pathway model was the positive association between oral health well-being and general well-being, albeit on a nonsignificant pathway. A positive association between the severity of impact due to oral health and the general state of being is counterintuitive, under the common sense. It is a good opportunity for future research to explore this finding and investigate additional constructs, like age or education, that may moderate our model's pathways. Moreover, this oddity may very well be related to the characteristics of our sample and still not be identified in other samples.

Existing research already look into effective therapeutic reduction of dental fear, due to its association with poorer levels of oral health and well-being.⁵⁹ Moreover, concrete action, ranging from collaboration between dentistry clinicians and behavioral health practitioners within multidisciplinary settings⁵² to community-based outreach centers for vulnerable groups,⁵⁵ is recommended.

However, the most important finding of our research was the central role of self-esteem in relation with all the other three main constructs. Not only was self-esteem a perfect mediator between general well-being and its other predictors, but it also explained a significant part of the relation between the specific dental fear and oral-health-related well-being. It is hard to conceive psychological and behavioral models that account for the oral-health-related well-being and its specific and general effects, without considering self-esteem. This is another opportunity for future research to explore conceivably and arguably very important role of self-constructs.

With respect to the state of the art, our research produced a feasible model that showed significant associations between the constructs of interest. It also opens the doors for consequent research interested in validating the directions of influence, as well as for research interested in enriching the model by incorporating new and relevant potential explanatory variables. With implications for both practice and research, we trust that our model brings a modest but solid contribution to the field of oral-health-related quality of life.

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Author contributions

All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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