Impact of Prosthetic Characteristics and Life Stress on Oral Health Related Quality of Life in Anterior Fixed Dental Prosthesis Treatment

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: This cross-sectional study aimed to explore potential factors influencing oral health related quality of life (OHRQoL) in a Chinese population treated with anterior dentition fixed dental prosthesis (FDP).
Study Design: Cross-sectional study.
Place and Duration of Study: West China Hospital of Stomatology, Sichuan University, between December 2012 and May 2013.
Methodology: According to the patient records in the dental hospitals, 1918 patients were initially selected and invited for a follow-up examination. After the selection, 987 participants were finally included and asked to complete a questionnaire which included three forms: Basic information, the Chinese version of Oral Health Impact Profile-14 items (OHIP-14) and Social Readjustment Rating Scale (SRRS). After data collection, independent sample t-test, one-way ANOVA and spearman

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rank correlation were used to assess each variable's independent impact on OHRQoL, while multifactor impact was evaluated by stepwise linear regression.

Results: 987 responses were acquired. Higher age caused a higher OHIP-14 score. For prosthesis material, all ceramic presented the lowest OHIP-14 score. For prosthesis type, veneer presented the lowest OHIP-14 score. Either prosthesis service time or SRRS score was positively correlated to OHIP-14 score. In stepwise linear regression, prosthesis material/service time/type and life stress were finally defined as OHRQoL predictors.

Conclusion: Three prosthetic characteristics (prosthesis material/service time/type) and life stress are responsible for OHRQoL level of patients treated with anterior FDP.

1. INTRODUCTION

Patient-based measurement proved that fixed prosthodontic treatment can improve patients' oral health status [1]. Fixed prosthodontic treatment also has a positive effect on patients' oral health related quality of life (OHRQoL) [2,3]. OHRQoL is a multidimensional concept and has become an important outcome index for prosthodontic treatment [4]. OHRQoL can be influenced by many variables, including oral diseases, tooth loss, application of prosthesis, as well as socio-demographic, educational, psychological, and financial factors [5,6]. In fixed dental prosthesis (FDP) treatment, socio-demographic variables and prosthetic characteristics have various impacts on patients' OHRQoL level [7-10].

In anterior dentition rehabilitation, patient satisfaction with treatment is multidimensional, accounting for both aesthetics and function [11]. One study reported that setting FDP in aesthetic zone (anterior dentition) would lead to the deterioration of OHRQoL [8]. However, the influence factor of OHRQoL in anterior dentition FDP treatment has not been fully investigated. The impact of prosthetic characteristics, for instance, type of prosthesis material, amount of tooth received FDP treatment, needs to be further investigated. On the other hand, with the quickening pace of modern life, most urban residents are living in a high life stress environment. Stress can damage periodontal tissue which supports the dental prosthesis [12,13]. Extreme life stress would exert an unfavorable effect on oral health status [14]. Thus, life stress is also likely to have influence on patients' OHRQoL level in anterior FDP treatment.

Based on the above situation, we conducted this cross-sectional study in a Chinese urban population, aiming to explore potential influence factors of OHRQoL in anterior FDP treatment.

2. SUBJECTS AND METHODS

2.1 Study Participants and Procedure

Patient records in the dental hospitals were used to preselect potential participants. An individual would be considered if he/she met the following inclusion criteria: 1. 18-60 years old; 2. anterior dentition (defined as upper incisors/canines and lower incisors/canines) had received FDP treatment for at least one year. And the exclusion criteria were: 1. patient with serious systemic diseases, cognitive impairment or progressive oral diseases; 2. the presence of any other types of dental prostheses (implant, removable partial denture, etc.); 3. prosthesis loosening or fracture. 1918 patients were initially selected from the records and we invited them for a follow-up examination. We examined each patient FDP status, cross-checking with previous patient records, to further confirm whether it can be included. 987 participants were finally included and were asked to complete a questionnaire. This study was approved by the Ethics Committee of the West China Stomatology Hospital, Sichuan University (No.WCHSIRB-D-2012-00016). Written consents were obtained from all the participants before enrollment.

2.2 Questionnaires

The complete questionnaire included three forms: Basic information, the Chinese version of Oral Health Impact Profile-14 items (OHIP-14) and Social Readjustment Rating Scale (SRRS). Basic information form included the following items: Name, gender, age, amount of tooth treated with FDP, prosthesis material/service time/location/type. Among them, "amount of tooth

treated with FDP" was mainly divided into single and multiple; "prosthesis material" was divided into three categories: Composite resin, metal ceramic and all ceramic; "prosthesis location" included maxilla, mandible and both jaws; "prosthesis type" was divided into single crown, bridge and veneer. These prosthetic characteristics information were taken by investigator based on previous patient records.

OHIP provides a measure of the social impact of oral disorders and it is one of the most technically sophisticated instruments to measure OHRQoL [15]. It has been shown that the Chinese version of OHIP-14 has a good reliability and validity [16]. It consists of 14 items grouped into seven domains: Functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap, each of which contains two questions. Items are scored on 5-point scales ranging from 0 to 4. Higher score indicates poorer OHRQoL while lower score indicates better.

SRRS consists of 43 external stressful life events regarding work, family life and health issue, e.g., change in financial state, retirement, divorce, personal illness, etc. Response of "yes" or "no" for each event is used to indicate whether this event occurred in the past 12 months. A "life-change unit" value is assigned to "yes" response, varying for each event and indicating the severity of such specific event. The total score of SRRS is then calculated by adding up all life-change units values. The higher the total SRRS score, the more life stress people are facing and the more readjustment is required. The total score of SRRS presents the risk of stress-related illness: 30% chance (less than 150), 50% chance (150 to 299) and 80% chance (more than 300) [17]. In the present study, a validated Chinese version which has been modified to include 39 life events was adopted [18]. A good reliability was demonstrated by our pilot study (n = 60): Cronbach's alpha was 0.73 and test-retest coefficient was 0.83.

2.3 Statistical Analyses

Descriptive statistics were calculated for all of the demographic, prosthetic and life stress variables. Kolmogorov-Smirnov test showed OHIP score was normally distributed while prosthesis service time and SRRS score were not. The differences in OHIP-14 score between groups were compared individually (independent sample *t*-test for gender and amount of tooth treated with FDP;

one-way ANOVA for age, prosthesis material, location and type). The relationships between OHIP-14 score and continuous variables (prosthesis service time and SRRS score) were analyzed by spearman rank correlation test. Finally, stepwise linear regression analysis was performed to explore the multifactor impact on OHRQoL level. Variables with $P < 0.05$ were retained in the final model. All tests were performed using the SPSS 17.0 software (PASW Inc.; Chicago, IL, USA) and a level of $\alpha = 0.05$ was set for significance.

3. RESULTS

3.1 Descriptive Outcome of Participants' Features

Of the initial selected 1918 samples, 146 persons could not be contacted due to invalid phone number, 389 refused to participate, 121 were suffering from serious systemic diseases/cognitive impairment/progressive oral diseases, 95 were treated with other type of dental prosthesis, 172 FDPs treatment failed (loosening, fracture, etc), 8 invalid questionnaires. After the screening, we finally included 987 participants and acquired their valid responses.

As Table 1 showed, 373 (37.8%) patients had one single tooth received FDP treatment while the other 614 (62.2%) had multiple. Metal ceramic held the majority of the subjects (n = 429; 43.5%). Prosthesis service time ranged from 12 to 208 months with a mean of 63 months. Prosthesis was mainly set in maxilla (n = 451; 45.7%), while the main type of prosthesis was bridge (n = 491; 49.7%). Concerning the life stress, most of the participants (n = 808; 81.9%) had low risk of stress-related illness.

3.2 Univariate Impact on OHRQoL

Among demographic factors, prosthetic characteristics and life stress, the independent impact of each variable on OHRQoL was listed individually in Table *2*. Difference in gender, amount of tooth treated with FDP or prosthesis location was not significant. Difference among each age group was significant and OHIP-14 score increased as age increased. Comparison of OHIP-14 score among three prosthesis material groups was shown as: All ceramic < metal ceramic < composite resin, while comparison among three prosthesis types was listed as: veneer < single crown < bridge. In

addition, spearman rank correlation test identified two correlated variables for OHIP-14 score: prosthesis service time (r_s = 0.633, P < 0.001) and SRRS score (r_s = 0.554, P < 0.001).

Table 1. Demographic, prosthetic and life stress data of FDP wears (N = 987)

Variable	n (%)
Gender	
Male	453 (45.9%)
Female	534 (54.1%)
Age (years)	
18~24	189 (19.1%)
25~34	271 (27.5%)
35~44	224 (22.7%)
45~60	303 (30.7%)
Amount of tooth treated with FDP	
One	373 (37.8%)
Multiple	614 (62.2%)
Prosthesis material	
Composite resin	288 (29.2%)
Metal ceramic	429 (43.5%)
All ceramic	270 (27.4%)
Prosthesis service time (months)	[12, 208]; 63 mean ± 45 sd
Prosthesis location	
Maxilla	451 (45.7%)
Mandible	392 (39.7%)
Both jaws	144 (14.6%)
Prosthesis type	
Single crown	321 (32.5%)
Bridge	491 (49.7%)
Veneer	175 (17.8%)
Risk of stress-related illness	
30% chance (<150)	808 (81.9%)
50% chance (150-299)	125 (12.7%)
80% chance (≥300)	54 (5.5%)

3.3 Linear Regression Model for Multifactor Impact on OHRQoL

The linear regression predictive model showed the multifactor impact on OHIP-14 score (Table 3*).* After stepwise selection, gender, age, amount of tooth treated with FDP and prosthesis location were excluded while prosthesis material, prosthesis service time, prosthesis type and life stress were suggested to be OHRQoL predictors in this final model. Among three kinds of materials, when compared to composite resin, metal ceramic would report a lower OHIP-14 score, while all ceramic reported the lowest. Regarding prosthesis type, bridge resulted in a higher OHIP-14 score while veneer resulted in a lower score when compared to single crown.

Moreover, longer prosthesis service time or higher life stress would result in an increased OHIP-14 score, which represented worse OHRQoL.

4. DISCUSSION

This cross-sectional study presented the OHRQoL level of a Chinese population treated with anterior FDP. Based on the current results, demographic variables (age, gender) had negligible influence on OHRQoL, which was similar to John et al finding [19]. Despite higher age would cause a worse OHRQoL, age was not reserved in final regression model so it can not be defined as OHRQoL influence factor. It is suggested that the impact of prosthetic characteristics is dominated. Prosthetic characteristics of FDP comprise material, service time, location, type of FDP, etc. As performing FDP treatment in anterior dentition would impair OHRQoL more significantly [8], it is of importance to define which factors are responsible for the OHRQoL deterioration.

In anterior FDP treatment, our study found that amount of tooth treated with FDP seemed to have no impact on OHRQoL. Whether patient had only one tooth or multiple teeth received restoration caused no difference in OHRQoL level. Moreover, it is reported that OHRQoL level is related to the location of prosthesis, as performing prosthodontic treatment in anterior or posterior region would cause different OHRQoL outcome [20]. But when performing FDP treatment in anterior region which majorly affected esthetic dimension, we found that whether setting FDP in maxilla, mandible or both seemed to have no impact on OHRQoL.

The difference between each prosthesis material group was significant: All ceramic reported the lowest OHIP-14 score which implied the highest OHRQoL level. It is said that the choice of material would prominently affect the long-term effect of esthetic restorations [21]. All ceramic restoration has much superiority such as satisfying clinical longevity, good biocompatibility and long-lasting esthetic advantages [22-25]. Thus, it has been widespread applied, especially in anterior dentition esthetic restoration. Our study found that all ceramic performed better in improving patients' OHRQoL. It might be associated with its excellent biocompatibility or esthetic effect, but the deeply explanation needs further exploration.

Table 2. Univariate impact of each variable on OHIP-14 score

Variable	n	OHIP-14 (Mean ± SD)	Statistic	*P*
Gender			$t = 0.546$	0.585
Male	453	5.50±1.01		
Female	534	5.47±0.99		
Age †			$F = 34.597$	0.033
18~24	189	4.98±1.32		
25~34	271	5.35±0.87		
35~44	224	5.67±0.69		
45~60	303	5.86±0.96		
Amount of tooth treated with FDP			$t = -1.111$	0.267
One	373	5.43±1.14		
Multiple	614	5.51±0.90		
Prosthesis material ‡			$F = 174.502$	< 0.001
Composite resin	288	6.14±0.87		
Metal ceramic	429	5.48±0.65		
All ceramic	270	4.79±1.10		
Prosthesis service time	987		$r_s = 0.633$	< 0.001
Prosthesis location §			$F = 0.866$	0.421
Maxilla	451	5.46±0.86		
Mandible	392	5.47±1.04		
Both jaws	144	5.58±1.25		
Prosthesis type ¶			$F = 634.394$	<0.001
Single crown	321	5.06±0.24		
Bridge	491	6.19±0.59		
Veneer	175	4.28±1.17		
Life stress	987		$r_s = 0.554$	< 0.001

† Student-Newman-Keuls (SNK) test showed: 18~24 group <25~34 group < 35~44 group < 45~60 group
‡ SNK test showed: All ceramic < Metal ceramic < Composite resin
§ SNK test showed: no significance existed between each group
¶ SNK test showed: Veneer < Single crown < Bridge

Table 3. Stepwise linear regression analysis of OHIP-14 score

Independent variable	*B*	SE	Beta	*P*
Prosthesis material				
Composite resin				Reference
Metal ceramic	-0.317	0.065	-0.152	0.001
All ceramic	-0.830	0.069	-0.411	0.001
Prosthesis service time	0.006	0.001	0.274	< 0.001
Prosthesis type				
Single crown				Reference
Bridge	0.876	0.071	0.398	0.005
Veneer	-0.335	0.072	-0.152	0.033
Life stress	0.005	0.000	0.332	< 0.001
Constant	5.057	0.074		< 0.001

$R^2 = 0.492$, Adjusted $R^2 = 0.490$, P < 0.001; Gender, Age, Amount of tooth treated with FDP and Prosthesis location were excluded from final model

The regression analysis revealed that prosthesis service time was positively associated with OHIP-14 score. The mean FDP service time for our participants was nearly 5 years (63 months). Since our study was a cross-sectional investigation, only in this time period that we drew the following conclusion: The longer time patients used FDP, the more impairment of OHRQoL they would have.

Regarding the type of FDP design, single crown, bridge and veneer were the major modalities that

used in fixed prosthodontic treatment in anterior region. As Table 2 and Table *3* showed, bridge resulted in the worst OHRQoL status while veneer caused the best. The exciting performance of veneer may be explained as the minimum tooth impairment during tooth preparation, which needs further confirmation. Due to the lack of adequate prosthetic information, we did not discuss type of FDP design in detail. As design of FDP would impact patient's OHRQoL level, it is suggested that if impact of FDP design (impact of number of units, difference between cantilevered and fixed-fixed bridge, etc.) is explored more detailedly by future study, more valuable information is expected to get.

Beyond prosthetic characteristic, it is suggested that personal psychological factor highly impact on OHRQoL of patients received dental rehabilitation [26,27]. Since the impact of psychosocial variables on oral health was not clear enough [28], we firstly explored the influence of life stress on OHRQoL outcome in dental restoration. Life stress is a multi-dimensional construct consists of daily hassles and major life events. Importantly, life stress had a negative impact on oral health status [14], as well as patients' OHRQoL, revealed by our study. One possible explanation is psychological stress can cause not only immune system dysregulation, but periodontal tissue impairment also [12,13], and these would be detrimental for the prognosis of dental restoration. Thus, instructing patients to self-adjust with stressful life events will be beneficial for the long-term effect of anterior FDP treatment.

5. CONCLUSION

In conclusion, within the limitations of current investigation, it is suggested that three prosthetic characteristics (prosthesis material, prosthesis service time and prosthesis type) and life stress are responsible for the OHRQoL level of patients treated with anterior FDP.

ETHICAL APPROVAL

This study was approved by the Ethics Committee of the West China Stomatology Hospital, Sichuan University (No.WCHSIRB-D-2012-00016).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Personal information

Name	
Gender	Male Female
Age	
Amount of tooth treated with FDP	Single Multiple
Prosthesis material	Composite resin Metal ceramic All ceramic
Prosthesis service time	_____months
Prosthesis location	Maxilla Mandible Both jaws
Prosthesis type	Single crown Bridge Veneer

Fig. 1. Questionnaire used in our study: Personal information form

Oral Health Impact Profile-14 items

Difficulty chewing	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Trouble pronouncing words	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Uncomfortable to eat	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Sore spots	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Worried	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Miserable	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Less flavor in food	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Interrupt meals	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Upset	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Been embarrassed	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Avoid going out	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Trouble getting on with others	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Unable to function	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often
Unable to work	0=never 1=hardly ever 2=occasionally 3=fairly often 4=very often

Fig. 2. Questionnaire used in our study: Oral health impact profile-14 items

Social Readjustment Rating Scale

To use the scale, simply add up the value for the listed events that have occurred to you within the past year. If a particular event has happened to you more than once within the last 12 months, multiply the value by the number of occurrences. Enter your value total at the end of the list.

Life Event	Value of Life-Change Unit
Death of Spouse	100
Divorce	73
Marital separation	65
Jail term	63
Death of close family member	63
Personal injury or illness	53
Marriage	50
Fired at work	47
Marital reconciliation	45
Retirement	45
Change in health of family member	44
Pregnancy	40
Sex difficulties	39
Gain of new family member	39
Business readjustment	39
Change in financial state	38
Death of close friend	37
Change to a different line of work	36
Change in number of arguments with spouse	35
Major mortgage	31
Foreclosure or mortgage or loan	30
Change in responsibilities at work	29
Son or daughter leaving home	29
Trouble with in-laws	29
Outstanding personal achievement	28
Spouse begins or stops work	26
Begin or end school	26
Change in living conditions	25
Revision of personal habits	24
Trouble with boss	23
Change in work hours or conditions	20
Change in residence	20
Change in schools	20
Change in recreation	19
Change in church activities	19
Change in social activities	18
More minor mortgage or loan	17
Change in sleeping habits	16
Change in number of family get-togethers	15
Change in eating habits	15
Vacation	13
Holidays	12
Minor violation of laws	11

Total: _____

Fig. 3. Questionnaire used in our study: Social readjustment rating scale