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Factors Determining Satisfaction with Tooth Color

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Abstract:
Background: Tooth color is an important and integral determining factor of a beautiful smile, hence the continued development of safe and effective methods of treating tooth discoloration. However, the concept of satisfaction with tooth color could be subjective, being influenced by several factors. **Aims and Objectives:** To determining the factors that influence satisfaction with tooth color among a segment of patients with tooth discoloration, visiting the Restorative dentistry clinic of a tertiary health institution in Southern Nigeria, for treatment. **Methodology:** It was a comparative interventional study, involving 70 participants recruited consecutively from the outpatient clinic of the dental centre within the study period. Different restorative treatment methods were used for the management of tooth discoloration. A questionnaire (Global scale of Satisfaction) was administered to the study participants to determine their level of satisfaction with their tooth color before treatment, at 2 weeks, and 8 weeks after treatment.**Result:** Before treatment, 69(98.6%) of the participants were unhappy with the color of their teeth; the relationship between degree of dissatisfaction and social class was statistically significant(p=0.032), and the relationship between Vita shade assessment and satisfaction with tooth color was statistically significant (p=0.001).statistically significant (p>0.05) as a determinant, except for the baseline satisfaction with tooth color (p=0.000), At the first recall visit (2 weeks after treatment), the majority of the participants, 62(88.6%), were satisfied with their tooth color, while at the second recall visit (8 weeks after treatment), almost all the participants, 67(95.8%), were satisfied with their tooth color. The improvement in the level of satisfaction with tooth color after treatment was statistically significant (p=0.001). After treatment, no independent variable was a significant determinant (p>0.05) of satisfaction with tooth color, except for the improvement in tooth shade\color itself (p=0,001).

Key Words: Tooth Color, Satisfaction, Aesthetics, Dissatisfied

Introduction:

The desire for fulfillment and acceptance with one's appearance is an ever-present need of man. It is a well-established fact that the concept of a pleasing facial appearance is a multifactorial and subjective construct, being determined by factors such as facial volume and aging, symmetry and proportion, structural elements created by hard and soft facial tissues, as well as skin health and quality, all acting in harmony to produce a beautiful smile.

This tangible need has led to several innovations in healthcare to improve tooth color, which is an integral component of a beautiful smile. However, the role of culture and environment in defining the acceptability of these constructs cannot be undermined. It is largely reported that people generally desire pearly white teeth because tooth color isone of the important factors determining satisfaction with dental appearance.[1]

People generally desire pearly white teeth because several studies have reported that a person's tooth colorisone of the most important factors determining satisfaction with dental appearance.[1]

Alkhatib et al.[2] reported that self-satisfaction with tooth color decreases with increasing severity of tooth discoloration. Similarly, the study by Mabiaku et al.[3]on the impact of tooth discoloration on quality of life, it was concluded that tooth discoloration negatively impacts self-esteem. White teeth have been positively correlated with high ratings of social competence, intellectual ability, psychological adjustment, and relationship status.[4.5] Hence, treatments that improve satisfaction with dental aesthetics have been found to improve a patient's quality of life, especially the psychological component.[6]

Factors Influencing Patients' Satisfaction with Dental Aesthetics

Different studies over the years have repeatedly reported that satisfaction with dental aesthetics has been reported to be influenced by some sociodemographic factors such as culture, gender, age, and education.[7.2,8,4,9]

Culture: It has been reported that individual preference, cultural background, and social stratum can all influence the subjective recognition of tooth color,[7,10,4]in their study in Turkey, reported that 55.1% of the patients were dissatisfied with the color of their teeth. Xiao et al[8] gave a similar report of 52.6% dissatisfied subjects in China. On the contrary, in North America, Odioso et al, [10] reported that 34% of their study subjects were dissatisfied with their tooth color, while Shulman et al.[11], in a similar study, reported 31.6% were dissatisfied. These results show a variation in the level of dissatisfaction with tooth color from one culture to another. It is a well-established phenomenon that some people with a normal tooth color still desire a tooth whitening procedure.[4] This may probably be due to the influence of their cultural background.

Gender: This has been reported to have an impact on the general appearance of dental aesthetics. In the study by Elkany et al. and Akaslanetal,[12,4]Females were more dissatisfied with the general appearance of their teeth compared with males, but the difference was not significant. This disparity could be because the self-esteem of females could be more affected by physical injuries than that of males (Vallittu et al. 1996). In a similar Malaysian study by Tin-Oo et al.,[13] it was reported that females were more dissatisfied with their general dental appearance than the male participants, and dissatisfaction was significantly associated with the female gender.

On the other hand, Samorodnitzky-Naveh et al,[1] reported that females were more satisfied with the general appearance of their teeth than males in Israel. However, they also reported that their study subjects consisted of more males than females, as the participants were selected from patients attending a military clinic.

Age: In the study by Ajayi et al. and Akaslan et al.]14,4] (2009), age had an impact on dissatisfaction with dental esthetics. Adolescents and young adults were the most dissatisfied group in their study. Alkhatib et al,[2] reported that older people were more satisfied with their dental appearance in the United Kingdom. Younger people have greater preferences for whiter teeth. This may be related to the fact that young people could be more influenced by the media and that younger people are trying to look more beautiful and healthy, knowing that there is a strong link between appearance and social status, as expressed by better jobs and social acceptability.[2] Thus, older people may be more accepting of poorer dental appearance, may incorporate it in their self-image, and may have less desire to make changes. However, aging is not necessarily associated with a negative self-perception of dental appearance or tooth color.[2] The influence of age on satisfaction with dental aesthetics may suggest that perceived appearance is linked to cognitive factors other than social and cultural ones.[2]

Education: Education is one way by which self-esteem may be enhanced. Thus, it is possible that the attainment of higher education may indirectly improve self-satisfaction with tooth color. In the study by Akaslan et al.,[4] the level of education did not lead to changes in dissatisfaction in general appearance, but it led to a change in satisfaction with tooth color. In their study, with an increase in the level of education, dissatisfaction with tooth color decreased. Xiao et al.,[8] reported that dental esthetic satisfaction in a Chinese population was correlated with educational level, but not with age and gender. In another study, the percentage of those who hide their teeth while smiling decreased with an increase in educational level, indicating a positive relationship between the level of education and the degree of confidence while smiling.[4]

Methodology:

This study was carried out at the Conservative Dentistry Clinic, Department of Restorative Dentistry, University of Benin Teaching Hospital,Benin City, Edo State, Nigeria. The study was a comparative interventional study examining the impact of restorative treatment on the quality of life ofpatients with intrinsic tooth discoloration. The sample size was determined using the statistical formula for an international study in a clinic-based study, which is calculated by Fischer's Formula[15], $n = \frac{Z^2pq}{d^2}$. Where n = minimum sample size when population is greater than 10,000, Z =standard normal deviation, set at 1.96 corresponding to 95 percent confidence interval level, P =prevalence or proportion (representation of a key variable in research problem). This is estimated to be 24.5% (i.e. 0.25%),[16] q =1-p. q and p are complementary, d =maximum acceptable level of error (i.e. 5% in this case is 0.05)

In this study, the minimum calculated sample was 52. In view of attrition, 10% was added to the calculated sample size, giving a sample size of 57.2, which is approximately equal to 58. The study population for this study was made up of patients presenting with intrinsic tooth discoloration attending the Conservative Dentistry clinic in the department of Restorative dentistry at the teaching hospital within the study period, and who met the inclusion criteria. These were consecutively recruited into the study. The inclusion criteria were: patients with intrinsically discolored permanent teeth irrespective of etiological origin, intrinsically discolored teeth without previous treatment attempt, Patients older than 16 years of age, and all patients who gave their consent willingly. Ethical approval was obtained from the University of Benin Teaching Hospital Ethical Review Committee. Informed and written consent was obtained from those who met the inclusion criteria and were willing to participate in the study.

Shade assessment records were done using Vita shade classical (Zahnfabrik^R Germany), for visual records, and with the aid of two calibrated research assistants (κ=0.86). Adental colorimeter (KSD00786 Dar you Instrument Ltd, Canada) was used for instrumental shade assessment records. The research assistants utilizing the colorimeter were calibrated (κ=0.86).

Different treatment methods utilized for the participants ranged from Vital Bleaching, Non-Vital Bleaching, a combination of Extra coronal and Intra-coronal Bleaching, Micro and Macro-Abrasion, Composite Veneers, and down to Full Coverage Crowns. For the purpose of analysis, the social classes were divided into four categories: social classes I, II, III, and IV, which is a modification of the classification by Famuyiwa and Olorunshola.[17]

Global Rating of Satisfaction Questionnaire

The global rating of satisfaction questionnaire was just a single question with a 7-point Likert scale, ranging from 1 to 7. 1-Very dissatisfied, 2-Dissatisfied, 3-Slightly dissatisfied, 4-Neutral, 5-Slightly satisfied, 6-Satisfied, 7-Very satisfied. This was administered to the participants before treatment, then at 2 weeks (first recall) and at 8 weeks (2nd recall) after treatment.

Results:

Level of Satisfaction at Pretreatment

On presentation, 69(98.6%) of the participants were unhappy with the color of their teeth. The order of dissatisfaction were as follows: 11(34%) were very dissatisfied, 34(48%) were dissatisfied and 24(15.7%) were slightly dissatisfied (Table 1). The statistical analysis of collected data revealed that the relationship between socio-demographic characteristics and the degree of dissatisfaction with tooth color expressed was not statistically significant ($p>0.05$), except for the social class ($p=0.032$, Table 2). Most 12(17.1%) of those in the social classes I and II were "very dissatisfied," compared to those in social classes III and IV, who were the majority, 27(38.6%),and were simply "dissatisfied" (Table 2).

Most of those with "dark" 18(25.8%) and "very dark" 48(68.6%) shades were dissatisfied with their tooth color in the Vita shade assessment (Table 4). The relationship between tooth shade using Vita shade assessment and satisfaction was statistically significant ($p=0.001$, Table 4). Most participants with multiple 11(15.7%) and some with generalized 10(14.3%) tooth discoloration were "very dissatisfied" compared with those with single tooth discoloration, 3(4.2%). However, the relationship between the distribution of tooth shade and the level of satisfaction before treatment was not statistically significant ($p=0.321$).

The analysis for determinants of satisfaction with tooth color before treatment showed that no socio-demographic factor was statistically significant ($p>0.05$) as a determinant, except for the level of satisfaction based on the initial tooth shade\color ($p=0.000$, Table 5).

Level of Satisfaction after Restorative Treatment

Following restorative treatment at the first recall visit, the majority of the participants,62(88.6%), were satisfied in varying degrees with their tooth color ("slightly satisfied", "satisfied", "Very satisfied"); only 4(5.7%) were dissatisfied with their tooth color (Table 6). By the second recall visit, at 8 weeks after treatment, almost all the participants,67(95.8%), were satisfied with their tooth color in varying degrees; only 2(2.8%) were dissatisfied with their tooth color (Table 7). Further comparison of "the satisfaction with tooth color" before treatment and 2 weeks after treatment among the participants revealed that the treatment resulted in a significant improvement in

satisfaction with tooth color (p=0.001) (Table 8). Similarly, the comparison of "the satisfaction with tooth color" before treatment and 8 weeks after treatment, showed that treatment resulted in a statistically significant improvement in satisfaction with tooth color (p=0.001) (Table 9).

On final analysis of all independent variables in relation to satisfaction with tooth color after treatment, there were no significant determinants (p>0.05) of post treatment satisfaction with tooth color after treatment in this study (Table 10).

Table 1: Demographic characteristics among the participants

Characteristics	Frequency	Percentage
Age (years)		
≤20	12	17.1
21-25	19	27.1
26-30	23	32.9
>30	16	22.9
Gender		
Male	24	34.3
Female	46	65.7
Social class		
Class I	7	10.0
Class II	19	27.1
Class III	42	60.0
Class IV	2	2.9
Total	**70**	**100.0**

Table 2: Satisfaction among the participants at pre-treatment stage

Level of satisfaction (n)	Frequency (%)	Percentage
Slightly satisfied	1	1.4
Slightly dissatisfied	11	15.7
Dissatisfied	34	48.6
Very dissatisfied	24	34.3
Total	**70**	**100.0**

Table 3: Relationship between demographic characteristics and satisfaction with Tooth color among the participants at pre-treatment stage

Characteristics	Very dissatisfied	Slightly dissatisfied	Dissatisfied	Slightly satisfied	Total	P-value
Age (years)						0.707
≤25	12 (17.1)	4 (5.7)	15 (21.4)	0 (0.0)	31 (44.3)	
>25	12 (17.1)	7 (10.0)	19 (27.2)	1 (1.4)	39 (55.7)	
Gender						0.445
Male	7 (10.0)	3 (4.3)	13 (18.6)	1 (1.4)	24 (34.3)	
Female	17 (24.3)	8 (11.4)	21 (30.0)	0 (0.0)	46 (65.7)	
Educational attainment						0.367
Less than tertiary	3 (4.3)	0 (0.0)	7 (10.0)		10 (14.3)	
Tertiary	21 (30.0)	11 (15.7)	27 (38.6)	1 (1.4)	60 (85.7)	
Social class						0.032
I&II	12 (17.1)	6 (8.6)	7 (10.0)	1 (1.4)	26 (37.1)	
III&IV	12 (17.1)	5 (7.1)	27 (38.6)	0 (0.0)	44 (62.9)	
Total	**24 (34.3)**	**11 (15.7)**	**34 (48.6)**	**1 (1.4)**	**70(100.0)**	

P-value=Fisher's P-value

Table 4: Relationship of Tooth shade and distribution to satisfaction with tooth color among the participants at the pre-treatment stage

Characteristics	Very dissatisfied	Slightly dissatisfied	Dissatisfied	Slightly satisfied	Total	P-value
Vita shade						0.001
Very light	0	1	0	1	2(2.8)	
Light	1	0	1	0	2(2.8)	
Dark	7	1	10	0	18(25.8)	
Very dark	16	9	23	0	48(68.6)	
Colorimeter Shade						0.722
Very light	0	1	2	0	3(4.4)	
Light	4	3	8	1	16(22.8)	
Dark	6	2	6	0	14(20.0)	
Very dark	9	4	8	0	21(30.0)	
Very very dark	5	1	10	0	16(22.8)	
Distribution						0.321
Single	3	2	11	0	16(22.8)	
Multiple	11	6	9	1	27(38.6)	
Generalized	10	3	14	0	27(38.6)	
Total	**24 (34.3)**	**11(15.7)**	**34(48.6)**	**1(1.4)**	**70(100.0)**	

P-value=Fisher's P-value

Table 5: Determinants of level of satisfaction with tooth color before treatment among participants

Variable	Unstandardized Coefficients		Standardized Coefficients	T	P-value
	B	Std. Error	Beta		
Age (years)	0.236	3.202	0.011	0.074	0.941
Gender	-.467	2.615	-0.020	-0.179	0.859
Educational attainment	0.683	3.684	0.022	0.185	0.853
Social class	3.215	3.183	0.142	1.010	0.316
Vita shade assessment	-2.480	2.284	-0.211	-1.086	0.282
Colorimeter assessment	1.062	1.736	0.116	0.612	0.543
Distribution of discoloration	0.080	1.764	0.006	0.046	0.964
Level of satisfaction	-6.732	1.578	-0.480	-4.267	0.000
Constant	40.258	12.821		3.140	0.003

Table 6: Satisfaction with tooth color at 2 weeks post-treatment recall 1

Level of satisfaction (n)	Frequency (%)	Percentage
Slightly dissatisfied	1	1.4
Dissatisfied	3	4.3
Neutral	4	5.7
Satisfied	33	47.2
Slightly satisfied	17	24.3
Very satisfied	12	17.1
Total	**70**	**100.0**

Table 7: Satisfaction with tooth color at 8 weeks post-treatment recall visit 2

Level of satisfaction (n)	Frequency (%)	Percentage
Slightly dissatisfied	1	1.4
Dissatisfied	1	1.4
Neutral	1	1.4
Satisfied	28	40.0
Slightly satisfied	8	11.4
Very satisfied	31	44.4
Total	**70**	**100.0**

Post-treatment 2=8 weeks after treatment

Table 8: Comparing satisfaction with tooth color at pre-treatment and post treatment 1

Pretreatment	Post-treatment 1	Z	P-value	n (%)	n (%)
Level of satisfaction					
Very satisfied	0 (0.0)	12 (17.2)		-7.289	0.001
Slightly satisfied	1(1.4)	17 (24.3)			
Satisfied	0 (0.0)	33 (47.1)			
Neutral	0 (0.0)	4 (5.7)			
Dissatisfied	34 (48.6)	3 (4.3)			
Slightly dissatisfied	11 (15.7)	1 (1.4)			
Very dissatisfied	24 (34.3)	0 (0.0)			

Z= Wilcoxon Signed Ranks Test

Table 9: Comparing satisfaction with tooth shade at pretreatment and posttreatment2

Pretreatment	Post-treatment 2	Z	P-value	n (%)	n (%)
Level of satisfaction					
Very satisfied	0 (0.0)	31 (44.4)		-7.340	0.001
Slightly satisfied	1 (1.4)	8 (11.4)			
Satisfied	0 (0.0)	28 (40.0)			
Neutral	0 (0.0)	1 (1.4)			
Dissatisfied	34 (48.6)	1 (1.4)			
Slightly dissatisfied	11 (15.7)	1 (1.4)			
Very dissatisfied	24 (34.3)	0 (0.0)			

Z= Wilcoxon Signed Ranks Test

Table 10: Determinants of satisfaction with tooth color after treatment

Variable	B	S.E.	Wald	OR	95.0% C.I.	P-value
Age (years)	-0.186	1.044	0.032	0.830	0.107-6.424	0.858
Gender	-0.645	0.897	0.517	0.525	0.090-3.042	0.472
Educational attainment	20.171	1.161E4	0.000	5.757E8	0.000-0.000	0.999
Social class	2.201	1.445	2.323	9.038	0.533-153.347	0.128
Shade change in vita shade	-2.139	1.232	3.013	0.118	0.011-1.318	0.083
Shade change in vita colorimeter	-0.525	1.371	0.147	0.591	0.040-8.679	0.701
Constant	-39.950	2.321E4	0.000	.000	-	0.999

C.I.=Confidence Interval, OR=Odd Ratio

Ref in the regression were ≤25 years, male, less than tertiary education, social class1&2, no shade change Vita, no shade change colorimeter

Discussion:

Before intervention in this study, except for one participant (1.4%), all of the participants were dissatisfied with their tooth color (98.6%). The degree of dissatisfaction varied, with most reporting "dissatisfied" (48.6%), some were "very dissatisfied" (34.3%), while 15.7% were "slightly dissatisfied." Different Studies have reported the influence of socio-demographic factors such as culture, age, gender, educational status, and social class) on the degree of satisfaction with tooth color [2,8,4]. Elkany, et al.,[12] in their study, reported that most of the adolescents were dissatisfied with their dental aesthetics due to color and malalignment but the females were more dissatisfied than the males. Furthermore, they stated that females whose fathers were educated were more psychologically impacted than those whose fathers were illiterates. The males were reported to exhibit more smile confidence than the females. Similarly, Ajayi et al.,[14]reported that females were more dissatisfied with their tooth colour than males and that the older participants were more satisfied with their tooth color than the younger ones. Even in the choice of restorations, particularly in anterior aesthetic restorations, some studies have reported the influence of gender and age in arriving at an acceptable choice.[18,19]

However, in this study, none of the socio-demographic variables had a significant relationship with satisfaction with tooth color before treatment, except for social class ($p = 0.032$). Most of those in social classes I and II were "very dissatisfied" compared with those in social classes III and IV. This could be due to the fact that these classes of patients were more enlightened, being professionals whose jobs may require an impressive appearance and self-confidence, which is undermined by intrinsic tooth discoloration.

Furthermore, the relationship between tooth shade and satisfaction with tooth color was statistically significant in the Vita shade assessment before treatment ($p=0.001$). The results revealed that the darker the tooth shade, the more dissatisfied the patient was. This in line with the findings of Alkhatib et al.[2] and Xaio et al.,[8] who reported that dissatisfaction with tooth color worsened with the severity of discoloration. In this study, satisfaction with tooth color was significantly correlated (moderately and negatively) with most domains of OHIP-aesthetics and overall OHIP-aesthetics, except the physical pain domain, before treatment. This signifies that the less satisfied the patient is with his tooth color, the more severe the impact of the condition on different aspects (domains) and overall quality of his life. This is in line with the findings of Chankankra et al.[20] The physical pain domain reflects the presence of sensitivity of the teeth and soreness of the gums occurring in association with intrinsic tooth discoloration before treatment. The absence of a significant correlation in this domain could be due to the fact that dissatisfaction with tooth color is not necessarily associated with tooth sensitivity or sore gums, but rather it is a challenge of appearance.

The only statistically significant determinant of the impact of tooth discoloration on patients' lives among the participants was their expressed dissatisfaction with tooth color before treatment (p=0.0001). This implies that the degree of dissatisfaction with tooth color determined the severity of the impact on the quality of life of the patient, irrespective of the gender, culture, age, and educational status.

However, after treatment, the majority (88.2%) of the patients in the study expressed varying degrees of satisfaction with tooth color 2 weeks (1st recall) after treatment, and there was a drastic change from 98.6% dissatisfied patients before treatment to 95.8% satisfied patients at 8 weeks after treatment. The improved satisfaction in tooth color 2 weeks after treatment and 8 weeks after treatment was statistically significant (p=0.001). This implies that restorative treatment improves the level of patients' satisfaction with dental aesthetics. These findings are similar to those of Davis et al.,[21] who reported a 100% improvement in patient satisfaction with dental aesthetics after restorative treatment, as well as the reports of John et al.[6] and Grossman et al.[22]

Conclusion: In this study, the participants reported that they were dissatisfied with their tooth color before treatment at varying degrees, ranging from "slightly dissatisfied" to "very dissatisfied". Similarly, their level of satisfaction with their tooth color after treatment varied. The only statistically significant determinant of the degree of satisfaction with tooth color before treatment in this study population was social Class, whereas tooth color shade was the only significant determinant of the degree of satisfaction after aesthetic restorative treatment.

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