

Shade Preference of Artificial Teeth in Denture Wearing Local Population- A Cross-sectional Study

NEERJA MAHAJAN¹, SIMRAT KAUR², NEELAM SUMAN³

ABSTRACT

Introduction: No existing local literature and guidance is currently available regarding shade selection by the patients for artificial teeth set of complete denture. Results of studies done in other countries cannot be generalised in our local population; hence there is a need to know the desires of our population. Keeping this research question in mind, this study reflects the behavioural aspects and wishes of patients towards artificial teeth shades.

Aim: To observe and compare the shade preferences of artificial teeth during complete denture fabrication in diverse sample of both male and female patients in two different dental colleges.

Materials and Methods: A cross-sectional study was conducted in the Department of Prosthodontics and Crown and Bridge, KM Shah Dental College and Hospital, Vadodara and Sri Guru Ram Das Institute of Dental Sciences and Research, Amritsar during the time period of May 2016 to September 2019. A total of 824 participants with complete denture treatment needs, participated from two different

dental colleges. Upper anterior molds of Acry Rock (Ruthinium Dental Products Pvt., Ltd.,) acrylic teeth in 18 different shades of A1, A2, A3 A3.5, A4, B1, B2, B3, B4, C1, C2, C3, C4, D2, D3, D4, E1 and F1 were used and participants were asked to choose aesthetically pleasing shades for themselves in both the colleges. The frequency distribution was recorded and compared using the Chi-square test for statistical analysis for preference of shades between male and female participants of two colleges.

Results: The most preferred shades were A1, B1, D2 and E1 by both male and female participants in both the colleges and the shade selection was statistically significant (p -value=0.0018), while no statistically significant difference was seen in preference of shades between male and female participants at both the colleges.

Conclusion: Patients primarily preferred the lighter shades with high values. This should be kept in mind during treatment planning to increase the psychological acceptance of aged patients towards artificial dentures.

Keywords: Aesthetic, Artificial teeth, Complete denture

INTRODUCTION

Dental aesthetics is very well associated with positive effect on patients' self-esteem [1]. The psychology of looking and feeling good even in old age directly effects the quality of life. Elderly patients give importance to appearance because it affects social interactions [2].

In the study done by Carlsson GE et al., respondents agreed, that beautiful teeth were important for how person was treated by other people [3]. Denture treatment restores aesthetics, phonics and function for patients so that they can interact confidently in society. Aesthetics depend on anterior teeth selection which has no set rules but certain anatomical landmarks and manufacturer guides can be used for shape and size selection. Conventionally, teeth shades were selected in harmony with skin colour, hair and eyes but as media is influencing the masses and promoting extreme makeover, the preference of shades are becoming area of conflict between dentist and patient. Eventually patients demand should be given preference [4]. Preference to patient desires along with active participation while shade selection is very well advocated [5] but somehow missing in our day-to-day dental practice.

Contradictory studies showing inverse, moderate to strong and even no relation between skin tone and natural teeth values are available in literature [6-12]. Therefore, these studies have very low external validity for our local population. A few studies have been done in India regarding skin and tooth colour. A study by Veeraganta SK et al., found no significant relation between gender and skin colour to value of tooth shade [13] whereas another study showed an inverse relation [14]. The Indian skin tone varies according to geographic location and fall into three i.e., fair, medium and dark categories. Many patients in our day to day practice do wish for lighter shades

of teeth but there is no existing literature to guide. As a result, shade selection is usually done intuitively, based on the few shades available in market, past personal experience of dentist with their patients or at times left totally on the discretion of laboratory personnel.

In light of inconclusive evidence, the feasible option left is to respect the patient's wishes, therefore this initial study was designed to observe and compare the shade preference of artificial teeth amongst diverse sample of both male and female patients visiting two dental colleges. This may be even helpful to teeth manufacturing companies to come up with more choices or combinations of teeth shades based on local demands.

Null Hypothesis of the study stated that no difference exists between gender and college location on the shade preferences of artificial teeth in completely edentulous population visiting two dental colleges of Vadodara and Amritsar cities.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Prosthodontics and Crown and Bridge, of KM Shah Dental College and Hospital, Vadodara, SV and Department of Prosthodontics of Sri Guru Ram Das Institute of Dental Sciences and Research, Amritsar during the time period of May 2016 to September 2019. Approval to conduct the study was obtained from the respective ethics committees of both the institutes with approval nos. SVIEC/ON/DENT/RPI/6008 and 2632/IDSR/2016.

On the basis of reference study by Peltzer K et al., minimum of 206 participants were enrolled in the study [15]. Since, the sample was collected from 2 colleges; it was multiplied by multiplying factor of 2 for cluster sampling. $N=206 \times 2$. Therefore, 412 male and 412 female

participants from both the colleges were enrolled in the study, totalling to 824 participants.

Inclusion criteria: Patients with complete denture treatment needs above age group of 50 years, willing to participate in the study were included in the study.

Exclusion criteria: Patients with partial dentures, single complete dentures and having any serious vision problems or issues were excluded from the study.

The participation information sheet was given to all the patients and informed consent was obtained. A standard methodology was maintained in both the colleges. Upper anterior moulds of Acry Rock (Ruthinium Dental Products Pvt., Ltd.) acrylic teeth in 18 different shades of A1, A2, A3 A3.5, A4, B1, B2, B3, B4, C1, C2, C3, C4, D2, D3, D4, E1 and F1 were used to analyse the shade preference of participants [Table/Fig-1].



[Table/Fig-1]: Shade selection guide.

There are generally four categories to represent hue in shade guides. A represents yellow- red, B yellow, C grey and D as red- yellow-grey. Most natural teeth fall in the series of yellow and yellow red [16]. Lighter teeth shows lesser intensity and more proportion of yellow than the darker teeth showing more intensity and amounts of red [17]. Paravina RD et al., had classified shades into 4 types according to value [18]:

Highest value (shades A1, B1, A2, B2)

High value (shades C1, D2, A3, D4)

Medium value (shades B3, B4, C2, D3)

Low value (shades A3.5, C3, A4, C4)

Two more shades E1 and F1 also were supplied by manufacturer in acrylic teeth sets which fell in category of yellow shade only. Patients were shown shades in natural daylight between 10 AM-12 noon and asked to choose aesthetically pleasing shades for themselves. The reason for choosing the particular shade was also asked from participants.

STATISTICAL ANALYSIS

The data was then recorded in the Microsoft excel sheet and analysed using the SPSS version 25.0. The frequency distribution was recorded and compared using the Chi-square test for statistical analysis, with significance level of 0.05.

RESULTS

In this study, a total of 824 participants participated with 206 males and 206 females from each college. Mean age of male participants in SGRD College Amritsar was 63.62 ± 8.4 years and female participant was 61.01 ± 8.1 years. Mean age of male participants in KMSDCH, Vadodara was 65.31 ± 8.4 years and the female participant was 65.44 ± 7.3 years. The participants in KMSDCH preferred mainly A1 B1 B2 D2 E1 out of eighteen shown [Table/Fig-2]. The participants in SGRD College preferred shades A1 B1 C1 D2 E1 out of eighteen

[Table/Fig-3]. Four shades A1 B1 D2 and E1 were commonly preferred in both the centres, but no statistically significant difference was observed in preference of male and females in any specific shade. The results obtained were non-significant in all the shades. [Table/Fig-4].

Shade	Male		Female		Total
	n	%	n	%	
A1*	58	28.14	61	29.75	119
A2	4	1.94	2	0.98	6
A3	0	0	0	0	0
A3.5	5	2.43	0	0	5
A4	1	0.49	0	0	1
B1*	80	38.81	89	42.91	169
B2*	5	2.43	6	2.93	11
B3	1	0.49	4	1.95	5
B4	1	0.49	2	0.98	3
C1	7	3.40	2	0.98	9
C2	3	1.46	0	0	3
C3	1	0.49	6	2.93	7
C4	1	0.49	0	0	1
D2*	28	13.59	14	6.83	42
D3	2	0.97	2	0.98	4
D4	3	1.46	0	0	3
E1*	5	2.43	16	7.80	21
F1	1	0.49	2	0.98	3
Total	206	100	206	100	412

[Table/Fig-2]: Participants distribution according to gender for shade in KMSDCH college.

*highlighted shades are of maximum preference

Shade	Male		Female		Total
	n	%	n	%	
A1*	41	19.90	37	17.96	78
A2	3	1.46	2	0.97	5
A3	0	0	0	0	0
A3.5	0	0	2	0.97	2
A4	0	0	0	0	0
B1*	85	41.27	105	50.97	190
B2	4	1.94	4	1.94	8
B3	4	1.94	2	0.97	6
B4	0	0	4	1.94	4
C1*	10	4.85	10	4.85	20
C2	6	2.91	2	0.97	8
C3	3	1.46	1	0.49	4
C4	0	0	0	0	0
D2*	34	16.50	23	11.17	57
D3	3	1.46	2	0.97	5
D4	4	1.94	3	1.46	7
E1*	6	2.91	8	3.88	14
F1	3	1.46	1	0.49	4
Total	206	100	206	100	412

[Table/Fig-3]: Participants distribution according to gender for shade in SGRD college.

*highlighted shades are of maximum preference

[Table/Fig-5] shows statistically significant difference of shade preference between both the colleges. Shade preference for the lighter shade was seen more amongst KMSDCH population. The most preferred shades A1, B1, C1, B2, D2 E1 by males and female participants in both the colleges were in category of highest and high value groups as classified by Paravina RD et al., [18].

Shade	Male		Female		Total		Chi-square statistic value	p-value
	n	%	n	%	n	%		
A1	99	24.0	98	23.8	197	23.9	3.214	0.523
A2	7	1.7	4	1	11	1.3		
A3.5	5	1.2	2	0.5	7	0.8		
A4	1	0.2	0	0	1	0.1		
B1	165	40	194	47.1	359	43.6	9.086	0.059
B2	9	2.2	10	2.4	19	2.3		
B3	5	1.2	6	1.5	11	1.3		
B4	1	0.2	6	1.5	7	0.8		
C1	17	4.1	12	2.9	29	3.5	7.264	0.123
C2	9	2.2	2	0.5	11	1.3		
C3	4	1	7	1.7	11	1.3		
C4	1	0.2	0	0	1	0.1		
D2	62	15.0	37	9	99	12	1.063	0.587
D3	5	1.2	4	1	9	1.1		
D4	7	1.7	3	0.7	10	1.2		
E1	11	2.7	24	5.8	35	4.2		
F1	4	1	3	0.7	7	0.8	5.156	0.076

[Table/Fig-4]: Frequency distribution Chi-Square test to observe the difference between male and female participants.
p-value <0.05 to be considered significant. Total N=824 subjects

Shade	KMSDCH college		SGRD college	
	n	%	n	%
A1	119	28.9	78	18.9
A2	6	1.5	5	1.2
A3	0	0	0	0
A3.5	5	1.2	2	0.5
A4	1	0.2	0	0
B1	169	41	190	46.1
B2	11	2.7	8	1.9
B3	5	1.2	6	1.5
B4	3	0.7	4	1
C1	9	2.2	20	4.9
C2	3	0.7	8	1.9
C3	7	1.7	4	1
C4	1	0.2	0	0
D2	42	10.2	57	13.8
D3	4	1	5	1.2
D4	3	0.7	7	1.7
E1	21	5.1	14	3.4
F1	3	0.7	4	1
Total	412	100	412	100

χ^2 value=15.852, p-value <0.0018

[Table/Fig-5]: Frequency distribution Chi-Square test to observe the difference between two colleges.
p-value <0.05 to be considered as significant

DISCUSSION

The findings of this study demonstrate no difference in shade preference between male and female participants, showing that even male participants gave equal importance to lighter shades and displayed same cosmetic awareness as females. Statistically significant difference in shade selection was observed in preference of patients from two colleges. Therefore, null hypothesis was partly rejected.

This study indicates good cosmetic awareness of participating population. The major reason quoted for choosing aesthetically pleasing shade by patients was due to societal expectations and desire to look young and attractive. Many patients gave reason that in society, persons with lighter teeth are well accepted. Their relatives

and children also want them to have new dentures with nice looking teeth. A few patients in the study wanted lighter or brighter shades similar to those of their friends and relatives. Some even wanted nice and healthy teeth as those of their treating dentists. For some patients' the reason for wanting lighter teeth was related to expectations that the new denture should come with pleasing teeth.

In progressive India with changing socioeconomic conditions, mindset of elderly patients is also changing. No longer, fulfilment of functional requirement in denture can be given primary importance. Globalisation and digitalisation have affected all the economic classes thus, their aesthetic demands cannot be disregarded.

Many studies conducted abroad have already evidenced the desire of lighter shade teeth in population of varying age groups. It was seen that individual's satisfaction with tooth shade was age independent [19]. Tooth shade was considered as prime factor for dental aesthetics and generally people were interested in improving their appearance by teeth whitening [20]. Another study has emphasised that brighter teeth shade influenced the smile attractiveness which is independent of skin tone [21]. Teeth shade even affected the social perceptions [22]. Discontentment about tooth shade had adverse effect on patient's satisfaction regarding dental appearance [23]. It was also observed that common persons were more conscious of teeth shade as compared to dentist because they found dark teeth less appealing [24]. Psychophysical researches on image analysis have also shown that teeth whitening results in decisions towards better intellectual ability, social competence and relationships [25]. Therefore, it can be inferred that, no one likes stained or dark teeth. Even in media and society, dark and irregular teeth are detested and associated with low self-esteem. Light and brighter teeth are promoted cosmetically and considered healthier and more acceptable. After undergoing gradual physiologic changes in natural teeth i.e., attrition, abrasion, darkening, staining, pathological migration, fractures, caries and eventual periodontal loss, it may be quite natural for elderly patients to desire lighter shades in their dentures reflecting their desire to look young and healthy again. It boosts their confidence and improves self-worth. Therefore, the psychology and wishes of aged patients must be kept in mind for better acceptance of prosthesis.

Limitation(s)

There might be some variations in subjective way of shade selection due to age related problems in elderly. Results of the study cannot be generalised as only two dental colleges were involved. Results of the study should be interpreted with caution as it is just a preliminary study showing not in the literal sense desire of lighter teeth rather indirectly reflecting the psychology of aged patients aspiring for healthy set of nice looking teeth after tooth loss. More standardised approach with better quantitative and qualitative methodology can be applied in future studies of other dental colleges and private set-ups to support these results.

Future recommendations: The future studies on oral rehabilitations should be approached in holistic manner keeping in mind appearances of aged and psychological issues related to aging.

CONCLUSION(S)

Patients primarily preferred the lighter shades with high values. This should be kept in mind during treatment planning to increase the psychological acceptance of aged patients towards artificial dentures. These findings may also provide base for more research in the area of aesthetics and psychology of aged patients.

REFERENCES

- [1] Davis LG, Ashworth PD, Spriggs LS. Psychological effects of aesthetic dental treatment. *Journal of Dentistry*. 1998;26(7):547-54.
- [2] Newton JT, Prabhu N, Robinson PG. The impact of dental appearance on the appraisal of personal characteristics. *International Journal of Prosthodontics*. 2003;16(4):429-34.

- [3] Carlsson GE, Johansson A, Johansson AK, Ordell S, Ekläck G, Unell L. Attitudes toward dental appearance in 50-and 60-year-old subjects living in Sweden. *Journal of Esthetic and Restorative Dentistry*. 2008;20(1):46-55.
- [4] Roumanas ED. The social solution-denture esthetics, phonetics, and function. *Journal of Prosthodontics: Implant, Esthetic and Reconstructive Dentistry*. 2009;18(2):112-15.
- [5] Zarb GA, Bolender CL. Prosthodontic treatment for edentulous patients: Complete dentures and implant-supported prostheses. 12th ed. St. Louis: Mosby publications; 2004. Pp. 301.
- [6] Al-Nsour HF, Al-Zoubi TT, Al-Rimawi AS. Relationship between tooth value and skin color in patients visiting Royal Medical Services clinics of Jordan. *Electronic Physician*. 2018;10(3):6448-53.
- [7] Jahangiri L, Reinhardt SB, Mehra RV, Matheson PB. Relationship between tooth shade value and skin color: An observational study. *The Journal of Prosthetic Dentistry*. 2002;87(2):149-52.
- [8] Dosumu OO, Dosumu EB. Relationship between tooth colour, skin colour and age: An observational study in patients at the Ibadan Dental School. *African Journal of Biomedical Research*. 2010;13(1):09-14.
- [9] Esan TA, Olusile AO, Akeredolu PA. Factors influencing tooth shade selection for completely edentulous patients. *J Contemp Dent Pract*. 2006;7(5):80-87.
- [10] Dummett CO, Sakumura JS, Barens G. The relationship of facial skin complexion to oral mucosa pigmentation and tooth color. *Journal of Prosthetic Dentistry*. 1980;43(4):392-96.
- [11] Al-Dwairi Z, Shaweesh A, Kamkarfar S, Kamkarfar S, Borzabadi-Farahani A, Lynch E. Tooth shade measurements under standard and nonstandard illumination and their agreement with skin color. *International Journal of Prosthodontics*. 2014;27(5):458-60.
- [12] Haralur SB, Dibas AM, Almelhi NA, Al-Qahtani DA. The tooth and skin colour interrelationship across the different ethnic groups. *International Journal of Dentistry*. 2014;2014:146028.
- [13] Veeraganta SK, Savadi RC, Baroudi K, Nassani MZ. Differences in tooth shade value according to age, gender and skin color: A pilot study. *The Journal of the Indian Prosthodontic Society*. 2015;15(2):138-41.
- [14] Sharma V, Punia V, Khandelwal M, Punia S, Lakshmana R. A study of relationship between skin color and tooth shade value in Population of Udaipur, Rajasthan. *International Journal of Dental Clinics*. 2010;2(4):26-29.
- [15] Peltzer K, Hewlett S, Yawson A, Moynihan P, Preet R, Wu F, et al. Prevalence of loss of all teeth (edentulism) and associated factors in older adults in China, Ghana, India, Mexico, Russia and South Africa. *International Journal of Environmental Research and Public Health*. 2014;11(11):11308-24.
- [16] Rosenstiel SF, Land MF, Fujimoto J, Cockerill JJ. Contemporary Fixed Prosthodontics. St. Louis: Mosby, Inc. 2001;2001:380-416.
- [17] Baltzer A, Kaufmann-Jinoian V. The determination of the tooth colors. *Quintessenz Zahntechnik*. 2004;30(7):726-40.
- [18] Paravina RD, Powers JM, FAY RM. Dental color standards: Shade tab arrangement. *Journal of Esthetic and Restorative Dentistry*. 2001;13(4):254-63.
- [19] Odioso LL, Gibb RD, Gerlach RW. Impact of demographic, behavioral, and dental care utilization parameters on tooth color and personal satisfaction. *Compendium of Continuing Education in Dentistry*. (Jamesburg, NJ: 1995). Supplement. 2009;29(S35-41).
- [20] Samorodnitsky-Naveh GR, Geiger SB, Levin L. Patients' satisfaction with dental esthetics. *The Journal of the American Dental Association*. 2007;138(6):805-08.
- [21] Di Murro B, Gallusi G, Nardi R, Libonati A, Angotti V, Campanella V. The relationship of tooth shade and skin tone and its influence on the smile attractiveness. *J Esthet Restor Dent*. 2020;32(1):57-63.
- [22] Kershaw S, Newton JT, Williams DM. The influence of tooth colour on the perceptions of personal characteristics among female dental patients: Comparisons of unmodified, decayed and 'whitened' teeth. *British Dental Journal*. 2008;204(5):E9;discussion 256-57.
- [23] Tin-Oo MM, Saddki N, Hassan N. Factors influencing patient satisfaction with dental appearance and treatments they desire to improve aesthetics. *BMC Oral Health*. 2011;11(1):6.
- [24] Sabherwal RS, Gonzalez J, Naini FB. Assessing the influence of skin color and tooth shade value on perceived smile attractiveness. *The Journal of the American Dental Association*. 2009;140(6):696-705.
- [25] Joiner A, Luo W. Tooth colour and whiteness: A review. *Journal of Dentistry*. 2017;67:S3-10.

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Prosthodontics, Crown and Bridge, K M Shah Dental College and Hospital, Sumandeep Vidyapeeth, Piparia, Waghodia, Vadodara, Gujarat, India.
2. Reader, Department of Prosthodontics, Sri Guru Ram Das Institute of Dental Sciences and Research, Amritsar, Punjab, India.
3. Reader, Department of Prosthodontics, Sri Guru Ram Das Institute of Dental Sciences and Research, Amritsar, Punjab, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Neerja Mahajan,
Professor, Department of Prosthodontics, Crown and Bridge, K M Shah Dental College and Hospital, Sumandeep Vidyapeeth, Piparia, Waghodia,
Vadodara-391760, Gujarat, India.
E-mail: drneerjamahajan@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Oct 29, 2020
- Manual Googling: Dec 18, 2020
- iThenticate Software: Dec 22, 2020 (3%)

ETYMOLOGY: Author Origin**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Oct 26, 2020**Date of Peer Review: **Nov 25, 2020**Date of Acceptance: **Dec 19, 2020**Date of Publishing: **Jan 01, 2021**