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Assessment of oral hygiene habits and dietary habits in the patients with black chromogenic stains – A cross-sectional study.

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Abstract

Aim:to assess oral hygiene habits and dietary habits in the patients with black chromogenic stains on the teeth surface.

Methods: The dietary and oral hygiene practices of 65 patients with black chromogenic stains on their teeth surface were assessed using a questionnaire.

Results: There was significant association between gender and type of tooth brush, type of diet and coconut oil usage.

Conclusion: our study showed that majority of the participants had collard greens more often.

Summary: The present study was conducted in the department of Oral medicine & Radiology, Yenepoya Dental College & Hospital, Yenepoya deemed to be

University, Mangalore aiming at assessment of oral hygiene habits and dietary habits in patients with black chromo genic stains on teeth surface and objective of the study includes (1) To assess the oral hygiene habits in patients with black chromogenic stains on the teeth surface.(2) To assess the dietary habits in patients with black chromogenic stains on the teeth surface. After obtaining Ethical clearance from institutions ethical committee, patients were selected randomly from the outpatient reporting to the Department of Oral and Maxillofacial Radiology in between March 2022 to July 2022. Intraoral examination of each patient was performed to evaluate the presence of black stain. And then the patients diagnosed with presence of chromogenic black stain were interviewed by asking the questions from the questionnaire after obtaining the consent from the participants. Then each participant was asked questions regarding socio-demographic variables such as age, gender and place of residence. The second section of the questionnaire included questions regarding oral hygiene habits such as the type of dental brush, type of brushing technique and history of recurrent scaling. And the next section included questions on dietary habits such as type of diet, the vegetable they had more commonly, snacking between meals, frequency of having diary product and type of drinking water consumed.

Additionally, the participants were asked information regarding feeding habits during their infancy. The data collected were statistically analyzed using chi square test to observe the association between the socio demo graphic factors and the oral hygiene habits, dietary habits, Statistical analysis was performed with Statistical Package for the Social Sciences software (SPSS, version 10.5) package. The significance threshold was set at 5%. Results showed that there was no significant difference between gender and presence of BS. The results of our study indicate that a number of variables, including oral hygiene practices and dietary habits influenced tooth discoloration. Our study showed that patients with BS on tooth surface used to take more collard greens, dairy products and consumed tap water on a regular basis. Additionally, most of the participants used to brush their teeth in a horizontal direction. And majority of participants were breast fed during their infancy. All of these observations indicated that these factors could play a role in the formation of BS.

Keywords: chromo genic, stains, dietary habits, oral hygiene.

Introduction

One of the most common reasons patients consult dentists is tooth discolouration, which is linked to both clinical and aesthetic issues. It frequently serves as a source of poor self-esteem and humiliation, especially in young patients. The formation of “unsightly black spots” on the surface of the tooth, universally known as Black Stain (BS) has recently been acquiring more interest.

Over the years, several attempts have been made to solve the mystery of the occurrence of black stains appearing as black line on the lingual and palatal surfaces of teeth along the cervical enamel of tooth running parallel to gingival margin. These black stains have been found to be recurrent in nature and are firmly attached to the teeth which are considered as special form of dental plaque with a tendency for calcification. Colour producing “chromogenic bacteria “, are suspected to be the cause of these black stain.[1]

The appearance of tooth discolorations is related to their etiology, composition, quantity, hardness and attachment to the tooth enamel. Yellow, green and orange discolorations caused by chromogenic bacteria from dent bacterial plaque are soft and usually found in patients

with low oral hygiene.[2] Whereas, studies have shown that the chromogenic black stain is most commonly seen in children and adults with good oral hygiene and low caries incidence .[3] Intrinsic stains are related to enamel and dentin properties, whereas extrinsic stains are associated to deposition of either food or beverage stains on the tooth surface, poor tooth brushing techniques, smoking, dietary intake of tannin-rich foods, excess use of chlorhexidine mouth wash, and/or consumption of metal salts.[4]

According to Reid et al., the black substance is a ferric salt, presumably ferric sulphide, created by the combination of iron in saliva or gingival fluid and hydrogen sulphide produced by bacterial action. The fundamental cause of this pathology, along with chromogenic bacteria, is BS, which is the build-up of iron in tissues and secretions. When iron present in saliva combines with hydrogen sulphide produced by bacteria in the oral cavity, pathological conditions result in black precipitates made of ferric sulphide. These precipitates stick to the teeth's surface, tending to produce striae that typically follow the gingival contour.[5] According to Harald et al. tooth pigmentation is formed by precipitation of chromogenic bacteria from Dento bacterial plaque, deposition of coloured substances from the substrate present in the oral cavity, or formation of coloured substances due to chemical decomposition of pellicle components.[2] Additionally studies have shown that the occurrence of these black stains tends to decrease with age and following the eruption of permanent teeth.[6] Studies have also found an increase in the salivary pH and buffering capacity in individuals with BS.[7] Studies have showed that patients with black pigmentation used to take more beets, whereas patients without pigmentation used more collard greens and red wine.

Currently, frequent dental prophylaxis is the major treatment for the existence of BS, which can harm the enamel microstructure and increase dental sensitivity. A study that could reveal the distinctive characteristics linked to black chromogenic stains and spares these patients from having to undergo recurrent scaling. The goal of this study was to find common characteristics, such as socio-demographic factors, oral hygiene practices, and dietary habits, including the type of water consumed and infant feeding practices that may influence how BS manifests in certain individuals.

Materials and methods

This cross-sectional study was conducted in the department of Oral medicine & Radiology, Yenepoya Dental College & Hospital, Yenepoya deemed to be University, Mangalore. In order to estimate anticipated proportion with 90% level of confidence, 10% margin of error 65 subjects aged 15 – 40 years healthy individual with chromogenic black stains on the teeth surface were included in the study. The patients having deleterious habits like smoking and having orange, yellow or other coloured stains were excluded from the study. Participants were selected randomly from the out-patient reporting to the Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore in between March 2022 to July 2022. The study was conducted after obtaining ethical clearance from the Ethics Committee - 2, Yenepoya University.

Intraoral examination of each patient was performed to evaluate the presence of black stain. And then the patients diagnosed with presence of chromogenic black stain were interviewed by asking the questions from the questionnaire after obtaining the consent from the participants. Before the questionnaire-based interview, all participants received a thorough explanation of

objectives and purpose of the study. The participation in the study was entirely voluntary.

Then the each participant was asked questions regarding socio-demographic variables such as age, gender and place of residence. The second section of the questionnaire included questions regarding oral hygiene habits such as the type of dental brush, type of brushing technique and history of recurrent scaling. And the next section included questions on dietary habits such as type of diet, the vegetable they had more commonly, snacking between meals, frequency of having diary product and type of drinking water consumed. Additionally, the participants were asked information regarding feeding habits during their infancy.

Statistical analysis

The data collected were statistically analyzed using chi square test to observe the association between the socio demographic factors and the oral hygiene habits, dietary habits, Statistical analysis was performed with Statistical Package for the Social Sciences software (SPSS, version 10.5) package. The significance threshold was set at 5%.

Results and observation

The present study was conducted to assess the oral hygiene habits and dietary habits among the patients with chromogenic black stains on the tooth surface aged 15 - 40 year. The data obtained from the study was subjected to statistical analysis. It showed the following results.

- Table 1 shows the distribution of study participants based on gender. The study comprised 31 male (47.7%) and 34 females (52.3%).
- Table 2 shows the distribution of study participants based on age. The study participants were categorized into four age groups. Among 65 participants, the majority of the participants (69.2%) were in the age group of 20-25years. The number and percentage of participants in the age group of 26-30, 31-35 and 36 -40 were 7 (10.8%), 6(9.2%) and 7(10.8%) respectively.
- Table 3 shows the number and percentage of responses to the question – Which type of tooth brush do you use for brushing the teeth? Among 65 participants, 35(53.8%), 26(40%) and 4(6.1%) were using medium, soft and hard tooth brush respectively.
- Table 4 shows the number and percentage of responses to the question – Which type of brushing technique do you use? Among 65 participants, 34(52.3%), 26(39.0%) and 5(67.7%) were following horizontal, vertical and rolling/other brushing strokes respectively.
- Table 5 shows the number and percentage of responses to the question – Do you rinse your mouth after eating? Among 65 participants, majority of the participants 47(72.3%) were rinsing mouth after eating. 18(27.7%) were not rinsing the mouth after eating.
- Table 6 shows the number and percentage of responses to the question – – Do you clean your tongue? Among 65 participants, 37(57.0%) were not cleaning the tongue and 28(43.0%) were cleaning their tongue.
- Table 7 shows the number and percentage of responses to the question – How often do you change tooth brush? Among 65 participants, the majority of the participants (73.8%) were changing the tooth brush within 3 months. The number and percentage of participants that were changing the tooth brush within 6 months were 17(26.2%). There were no participants who were changing tooth brush after 6 months.
- Table 8 shows the number and percentage of responses to the question – Have you ever undergone professional cleaning of teeth surfaces? Among 65 participants, 38(58.5%) had undergone professional cleaning of teeth surfaces and number and percentage of

participants who have not undergone professional cleaning were 27(41.5%).

- Table 9 shows the number and percentage of responses to the question – Which type of diet do you have? Among 65 participants, majority of the participants 44(67.7%) were having mixed type of diet. The number and percentage of participants who were having non – veg and veg diet were 18(27.7%) and 3 (4.6%) respectively.
- Table 10 shows the number and percentage of responses to the question – Which vegetable among the following you have more often? Among 65 participants, majority of the participants 35(53.9%) were having collard greens more often. The number and percentage of participants who were having beets and carrot more often were 18(27.7%) and 12 (18.5%) respectively.
- Table 11 shows the number and percentage of responses to the question – Do you have snacks in between meals? Among 65 participants, majority of the participants 50(77.0%) were having snacks in between meals sometimes. The number and percentage of participants who were having snacks in between meals usually were 11(16.9%). 4(6.1%) of them never had snacks in between meals.
- Table 12 shows the number and percentage of responses to the question – How often do you have carbonated drinks? Among 65 participants, majority of the participants 51(78.5%) were having carbonated drinks sometimes. The number and percentage of participants who were having carbonated drinks usually were 4(6.2%). And 10(15.4%) of them never had carbonated drinks.
- Table 13 shows the number and percentage of responses to the question – How often do you have dairy products? Among 65 participants, majority of the participants 36 (55.4%) were having dairy products sometimes. The number and percentage of participants who were having carbonated drinks usually were 27(41.6%). And 2 (3%) of them never had dairy products.
- Table 14 shows the number and percentage of responses to the question – Which type of water do you use for drinking? Among 65 participants, the number and percentage of participants who were having tap water/filter water, well water and mineral water were 33(50.8%), 29(44.6%) and 3(4.6%) respectively.
- Table 15 shows the number and percentage of responses to the question – Have you been breastfed in your infancy? Among 65 participants, majority of the participants 62(95.4%) were breast fed in infancy and only 3(4.6%) of participants were not breast fed in infancy.
- Table 16 shows the number and percentage of responses to the question – Have you used milk powder (Nan/Lactogen) for feeding in your infancy? Among 65 participants, majority of the participants 53(81.5.%) we're not using milk powder for feeding in infancy and 12(18.5%) of participants were using milk powder for feeding in infancy.

Table 1: distribution of the participants based on gender

Gender	Frequency	Percent
Male	31	47.7%
Female	34	52.3%
Total	65	100.0%

Table 2: distribution of participants based on age

Age- groups	Frequency	Percent
20-25	45	69.2
26 – 30	7	10.8
31 – 35	6	9.2
36 - 40	7	10.8
Total	65	100.0

Table 3: Number and percentage of responses to the question – Which type of tooth brush you use for brushing the teeth?

Type of tooth brush	Frequency	Percentage
Soft	26	40%
Medium	35	53.8%
Hard	4	6.1%

Table 4: Number and percentage of responses to the question – Which type of brushing technique do you use?

Brushing technique	Frequency	Percentage
Horizontal stroke	34	52.3
Vertical stroke	5	7.7
Rolling stroke/others	26	39.0

Table 5: Number and percentage of responses to the question – Do you rinse your mouth after eating?

Mouth rinsing after eating	Frequency	Percentage
Yes	47	72.3
No	18	27.7

Table 6: Number and percentage of responses to the question – Do you clean your tongue?

Tongue cleaning	Frequency	Percentage
Yes	28	43.0
No	37	57.0

Table 7: Number and percentage of responses to the question – How often do you change tooth brush?

Frequency of changing tooth brush	Frequency	Percentage
Within 3 months	48	73.8%
Within 6 months	17	26.2%
More than 6 month	0	0%

Table 8: Number and percentage of responses to the question – Have you ever undergone professional cleaning of teeth surfaces?

Professional cleaning of teeth surfaces	Frequency	Percentage
Yes	38	58.5%
No	27	41.5%

Table 9: Number and percentage of responses to the question – Which type of diet do you have?

Type of diet	Frequency	Percentage
Veg	3	4.6%
Non veg	18	27.7%
Mixed	44	67.7%

Table 10: Number and percentage of responses to the question – Which vegetable among the following you have more often?

Vegetable consumed often	Frequency	Percentage
Beets	18	27.7%
Collard greens	35	53.9%
Carrot	12	18.5%

Table 11: Number and percentage of responses to the question – Do you have snacks in between meals?

Snacking in between meals	Frequency	Percentage
Usually	11	16.9%
Sometimes	50	77%
Never	4	6.1%

Table 12: Number and percentage of responses to the question – How often do you have carbonated drinks?

Consumption of carbonated drinks	Frequency	Percentage
Usually	4	6.2%
Sometimes	51	78.5%
Never	10	15.4%

Table 13: Number and percentage of responses to the question – How often do you have dairy products?

Consumption of dairy products	Frequency	Percentage
Usually	27	41.6%
Sometimes	36	55.4%
Never	2	3%

Table 14: Number and percentage of responses to the question – Which type of water do you use for drinking?

Source of drinking water	Frequency	Percentage
Well water	29	44.6%
Tap water/ filter water	33	50.8%
Mineral water/ package drinking water	3	4.6%

Table 15: Number and percentage of responses to the question – Have you been breastfed in your infancy?

Breast feeding in infancy	Frequency	Percentage
Yes	62	95.4%
No	3	4.6%

Table 16: Number and percentage of responses to the question – Have you used milk powder (Nan/Lactogen) for feeding in your infancy?

Use of milk powder in infancy	Frequency	Percentage
Yes	12	18.5%
No	53	81.5%

Table 17: Comparison of the participants based on the type of tooth brush used

Gender	Type of tooth brush			Chi-square value	p value
	soft	medium	hard		
Male	7	21	3	7.817	0.02
	10.8%	32.3%	4.6%		
Female	19	14	1		
	29.2%	21.5%	1.5%		
Total	26	35	4		
	40%	53.8%	6.1%		

Discussion

Studies have reported incidence of BS to be 1-20% which affect both primary and permanent teeth and reduces as the age advances.[8,9,10] The reported prevalence of black stain varies from study to study, according to subject age and country of origin. In Europe, it ranges from 1.6% (UK), 4.45% (Poland), 6.3% (Italy), to 7.54% (Valencia, Spain). In South America, it ranges from 6.5% (Peru) to 14.8% (Brazil). On the Asian continent, it varies from 16% (Philippines) 11 to 18% (India).[11, 12]

BS is a type of extrinsic stain which is difficult to remove with everyday brushing and tends to reform after professional scaling. Individuals with BS may experience aesthetic issues;

however, no associated dental health impairment has been documented. The majority of epidemiological studies conducted worldwide shown that the presence of BS as a caries resistance factor.[6, 11] In experimental studies carried out on animals, it was observed that a diet that includes iron supplements reduces the acidogenic capacity of the dental plaque and is associated with a lower amount of caries.[12]

Koch et al (2001) used the following criteria for the diagnosis of black stain: the presence of dark dots (diameter less than 0.5mm) forming linear discoloration (parallel to the gingival margin) at dental smooth surfaces of at least two different teeth without cavitation of the enamel surface.[13] Its formation is attributed to the colonization of the membrane of Nasmyth by chromo genic bacteria belonging to the following families: Porphy romonas, Prevotella and Actino myces, which require vitamin K and hemin for development.[12]

Several factors such as socio demo graphic character ristics, oral hygiene habits and dietary habits were assessed in previous studies among patients with black chromogenic stains.[1, 2, 3, 6, 12, 14] Our study included participants from different age groups such as 20 – 40-year-olds with the objectives to assess the oral hygiene habits and dietary habits in patients with black chromo genic stains in the teeth surface.

In our study we did not find significant difference between gender and presence of BS which is in agree Ment with the several studies published.[1, 15, 9] However

in our study there was significant difference in the use of type of tooth brush between the genders (p value = 0.02), where 29.2% of females were using soft type of tooth brush and only 10.8% of males were using soft type of tooth brush. Additionally, majority of the participants were brushing teeth in horizontal method. Usually, horizontal movements are considered ineffective to clean the interproximal spaces and the gingival sulcus of the permanent teeth. Brushing techniques mainly based on vertical movements of the toothbrush bristles, like the Roll technique and the modified Bass technique, are considered more effective in plaque removal and less aggressive for the soft tissues and they are commonly re commended by dental personnel.[16] Some authors have pointed out that individuals with BS might demonstrate better oral hygiene, in an attempt to control BS extension, which in turn will lead to improved oral health.[3] In a study conducted by Lopez et al[1] there was conflicting evidence about the influence of oral hygiene in BS, where they did not find significant difference amongst participant groups.

In a study conducted by JM Garcia Martin et al, it was emphasized that the consumption of specific foods rich in iron, such as vegetables, legumes, dairy products and eggs is likely to favour the growth and colonization of the oral cavity by the involved bacteria in the development of black stain.[12] in our present study majority of the participants were having collard greens that are good source of vitamin K, vitamin C and iron which is also in line with the study conducted by JM Garcia Martin et al, where they found statistically significant relationship between black stain and the consumption of food with high iron content as well as beverages containing vitamin C.[12] Whereas in a study conducted by Katica PRs kalo et al, showed that parti cipants with BS were taking more beets which is in contradiction with our study.[2] In our study majority of the participants were having dairy products on a regular basis.

Snacking decreases salivary pH regularly, thus snacking between meals could play a protective role against BS, due to the effect on salivary pH, promoting acidify cation.[1] In our study, a small percentage of respondents snacked in between meals on a regular basis, which is consistent with prior studies indicating that individuals with BS have higher salivary pH.[7, 10]

Lactoferrin is major iron-binding constituent of milk and analysis of lactoferrin in cheese showed that this protein stayed intact throughout ripening in raw milk cheese.[17] Lactoferrin protein has a high affinity for iron and it can bind iron present in saliva. Bovine lactoferrin has four glycan chains which may contribute to a better adherence to tooth surface especially cheese stays much longer in contact with tooth surface which could explain that dairy products are associated with BS.[18] In our study also most of the participants had dairy products on a regular basis which is in line with previous studies. [5, 12, 14]

Ellingsen et al (1982) have reported the presence of sulfhydryl groups in the plaque material that reacts with metals (particularly iron) to form coloured sulfides. The source of the sulfur component could be sulfur containing salivary or bacterial proteins.[19]

Tap or osmosis purified water has higher iron content which could contribute to the formation of BS. It is found that most of the participants chose the option of using tap water/ osmosis purified water for drinking, in our study which is in accordance with earlier studies.[1,12, 10]

It was also observed that in our study, the majority of the participants were breastfed throughout their infancy, which is consistent with earlier studies that demonstrated

a higher number of teeth with black stains in those who were breastfed rather than nursing bottle fed.[14, 20]

Limitations of the study

- There was no control group in our study that included those who did not have chromogenic black stains on their tooth surfaces.
- Our study lacked a grading system for determining how much stain covered the tooth surface.
- The study should have included a larger number of participants.
- The variables are determined by the responses of the participants, which is susceptible to information bias.

Conclusion

The results of our study indicate that a number of variables, including oral hygiene practices and dietary habits influenced tooth discoloration. Our study showed that patients with BS on tooth surface used to take more collard greens, dairy products and consumed tap water on a regular basis. Additionally, most of the participants used to brush their teeth in a horizontal direction. And majority of participants were breast fed during their infancy. All of these observations could imply that these factors could play a role in the formation of BS. However, further studies with food and drink intake are required to be conducted along with control group to evaluate the local factors contributing to the formation of BS and to understand the interplay between the microflora, diet and oral hygiene habits.

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