DOI: 10.7860/JCDR/2020/45908.14408

Original Article

Dentistry/Orthodontics Section

Colour Preferences of Elastic Ligatures among Orthodontic Patients

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ABSTRACT

Introduction: Elastic modules are an integral part of fixed appliances. The availability of different colours is important to patients and their compliance during treatment. Knowledge about the most popular colours is important to orthodontists when ordering their materials.

Aim: This study aimed to determine the elastic ligature colour preferences of patients undergoing fixed orthodontic treatment and the influences of age and gender on these preferences.

Materials and Methods: A total of 319 patients (88 males and 231 females) aged 18-36 years of age participated in this study. The patients' elastic ligature colour preferences were recoded using a colour guide and a self-administered questionnaire. The questionnaire contained questions about the patients' preferences regarding coloured or transparent ligatures, light or dark shades, and changing the ligatures for specific occasions. The data were analysed using SPSS version 25. The descriptive statistics were calculated, and a Pearson's chi-squared analysis was performed to determine the influence of age and gender effects on colour preferences (p-value <0.05).

Results: Most of the participants were excited about changing their elastic ligatures colours (44.5%), and they liked to change the colours at each visit (45.5%). Most participants did not like having multicoloured elastic ligatures in their mouths (77.4%) or changing the elastic colours before certain occasions (49.8%). There was no statistically significant difference in the elastic ligature colour preferences between the genders (p-value=0.0552), but there were statistically significant differences among the age groups (p-value <0.001).

Conclusion: Most of the patients undergoing orthodontic treatment with fixed appliances preferred less noticeable elastic ligature colours. A significant difference was found between age groups: younger patients preferred coloured elastics, while older patients preferred less noticeable and transparent elastics. No difference was found between the colour preferences among both the gender.

Keywords: Aesthetic, Coloured elastics, Fixed appliances, Orthodontist

INTRODUCTION

Elastic and metal ligatures are used in fixed orthodontic treatment to hold the archwires inside the bracket [1,2]. Due to their elasticity, archwire ligation with elastic ligatures is faster and easier compared to using metal ligatures [1,3]. However, several studies have shown that these elastic ligatures are vulnerable to salivary, bacterial, and food-related pigmentation, which can compromise the aesthetics of the ligatures and reduce their lifespan [2-6]. To overcome some of these shortcomings, manufacturers add colours to the elastic ligatures [2[, and the patient's acceptance of coloured elastic use varies according to their age and gender [1,7,8]. Previous colour preference studies have contradictory findings [3,9]. It has been suggested that ten different elastic ligature colours should be kept in stock at orthodontic clinics [1,3]. Although the availability of different coloured elastic ligatures may have a positive influence on patients' compliance during treatment, a limited number of studies have determined patients' coloured elastic preferences.

Elekdage-Turk S et al., reported that there was no significant difference in colour preferences between genders, but there was an enormous difference among age groups [1]. They found that younger patients prefer coloured ligatures, while older patients prefer less noticeable ligatures. Tariq S et al., showed a significant difference in colour preferences between genders but not concerning the ages of the patients [3]. They reported that females preferred red, pink, and purple colours, while males preferred blue and black colours.

The present study aimed to determine elastic ligature colour preferences among patients undergoing fixed orthodontic treatment and any age and gender influences on these preferences, which will help orthodontists have the most popular colours in stock and will affect patients' cooperation during treatment.

MATERIALS AND METHODS

This cross-sectional study determined the patients' elastic colour preferences. The study was conducted between July and September 2018 in the Orthodontic clinic at King Saud University in Riyadh, Saudi Arabia, and different private and Governmental Orthodontic clinics. The study protocol was approved by the Institutional Review Board (E-18-3307), King Saud University, College of Medicine in Riyadh, Saudi Arabia. The procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 2000 [10]. The sample size calculation was done as α=0.05 and effect Size (ES)=0.25 with Power= 0.90. The sample size thus calculated was 318.

Inclusion Criteria: A total of 319 patients (231 females and 88 males), aged between 18-36 years and who had undergone upper and lower fixed orthodontic treatments with metal brackets for at least six months were included in the study.

Exclusion Criteria: Participants who were less than 18 or more than 36 years, less than six months with metal brackets and who were unable to read and understand the questionnaire alone were excluded from the study.

The included participants were able to read, understand and fill the self-administered questionnaire. The informed consent was

signed by all the participants prior to being taking part in the study. The data were obtained from the study participants using a self-administered questionnaire that was distributed to them after they were shown a colour guide (to determine the colour that they preferred). The questionnaire [Annexure-1] was used in a previous study [3[and contained questions about the patient's age, gender, place where they were treated and their preferences for coloured or transparent ligatures, light or dark shades, and changing ligatures for specific occasions (e.g., Eid, wedding, birthday…. etc.,). It was given to the patients and the colour guide was shown to the participants; preferred colour/colours was recorded for each patient by researchers. The colours were then divided into transparent, less noticeable and colourful groups. The less noticeable group included white, silver and grey, and the colourful group included the more obvious colours: red, blue, green, black etc.

STATISTICAL ANALYSIS

The data were analysed using IBM SPSS Statistics for Windows (version 25.0; IBM Corp., Armonk, NY, USA). The descriptive statistics were calculated, and Pearson's chi-squared analysis was performed to determine the influence of age and gender effects on colour preferences. A p-value less than 0.05 were considered as statistically significant.

RESULTS

A total of 319 patients participated in this study (88 males and 231 females), and the age range was 18-36 years of age. Most of the participants were between 19 and 25 years old and were treated in the private sector. [Table/Fig-1] shows the sample characteristics, and [Table/Fig-2] shows the patients' answers to the questionnaire regarding their elastic ligature preferences. Most participants felt excited about changing their elastic colours (44.5%), and they liked to change the colours at each visit (45.5%). Most participants did not like having multicoloured elastic ligatures inside their mouths (77.4%), and they stated that they did not bother changing the elastic colours before certain occasions (49.8%).

[Tables/Fig-3,4] show the gender and age associations with patients' elastic colour preferences. There were no statistically significant differences in the elastic ligature colour preferences between the genders (p-value 0.552), but there were statistically significant differences between the age groups (p-value <0.001). Most of the participants who were 18 years of age preferred colourful elastic ligatures (47.6%), while the participants in age group 19-25 years old preferred less noticeable colours (42.1%). Those patients who were in age group of 26-35 years old and older than 35 reported that they did not have elastic ligature colour preferences (44.4% and 22.2%, respectively). Although the subjects were given the option to select more than one preferred colour, no patient was found to choose more than one preferred colour. [Tables/Fig-5,6] show the details of the elastic ligature colour preferences for each gender and each age group.

Variables studied	Number (n)	Percentage (%)
Number of patients	319	100
Gender		
Male	88	27.6
Female	231	72.4
Nationality		
Saudi	304	95.3
Non-Saudi	15	4.7
Place of Tx		
Private	201	63.0
Government sector	74	23.2
Academic institute	44	13.8
Age		
≤18	84	26.3
19-25	169	53.0
26-35	57	17.9
≥36	9	2.8

[Table/Fig-1]: Sample characteristics.
Tx: Treatment

Questions	Yes n (%)	No n (%)	Does not matter n (%)
Do you feel excited when ligatures are to be changed?	142 (44.5)	81 (25.4)	96(30.1)
Do you like to change the ligatures colour on each visit?	145 (45.5)	123 (38.6)	51(16)
Do you like to have different ligature colours inside your mouth at the same visit?	31 (9.7)	247 (77.4)	41 (12.9)
Do you like to change the colour of your ligatures before certain occasions such as Eid, etc., ?	75 (23.5)	159 (49.8)	85 (26.6)

[Table/Fig-2]: Patient's answers on the elastic ligatures' preferences questionnaire.

DISCUSSION

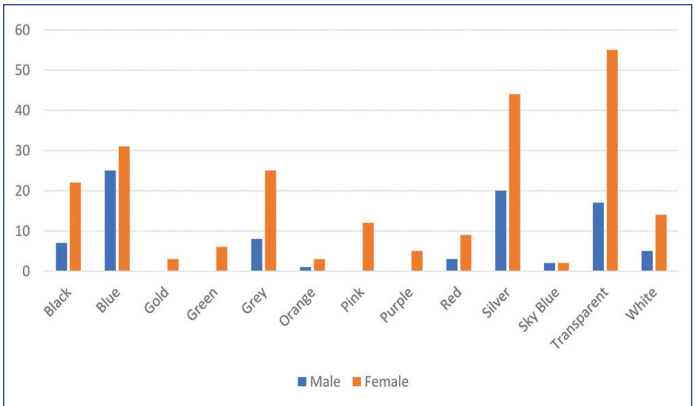
Three hundred and nineteen patients were included in this study, with females making up 72.4% of the total sample. Similar gender distributions were reported in the studies by Elekdag-Turk S et al., (76%) and Tariq A et al., (76%) [1,3] .The majority of the present

Gender	Coloured Ligatures n (%)	Less-noticeable ligatures n (%)	Transparent n (%)	Any of above n (%)	Total n (%)	Chi-square value	p-value
Male	30 (34.1%)	35 (39.8%)	16 (18.2%)	7 (8%)	88 (100%)	χ^2=2.101	0.552
Female	61 (26.4%)	96 (41.6%)	51 (22.1%)	23 (10%)	231 (100%)		
Total	91 (28.5%)	131 (41.1%)	67 (21%)	30 (9.4%)	319 (100%)		

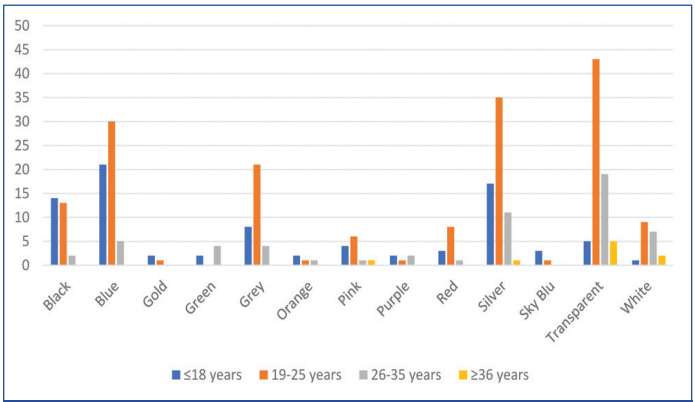
[Table/Fig-3]: Gender and colour preferences association.
χ^2=2.101; p=0.552; Coloured Ligatures: red, blue, green, black etc. Less- noticeable Ligatures: white, silver, pearl.

Age	Coloured Ligatures n (%)	Less-noticeable ligatures n (%)	Transparent n (%)	Any of above n (%)	Total n (%)	Chi-square value	p-value
18 years	40 (47.6)	28 (33.3)	6 (7.1)	10 (11.9)	84 (100)	χ^2=39.97	p=0.000
19-25 years	44 (26)	76 (45)	39 (23.1)	10 (5.9)	169 (100)		
26-35 years	7 (12.3)	24 (42.1)	18 (31.6)	8 (14)	57 (100)		
≥36 years	0 (0)	3 (33.3)	4 (44.4)	2 (22.2)	9 (100)		
Total	91 (28.5)	131 (41.1)	67 (21)	30 (9.4)	319 (100)		

[Table/Fig-4]: Age and colour preferences association.
χ^2=39.97; p-value <0.001; Coloured Ligatures: red, blue, green, black etc. Less- noticeable Ligatures: white, silver, pearl.



[Table/Fig-5]: Distribution of elastic ligatures colour preferences between females and males.



[Table/Fig-6]: Distribution of elastic ligatures colour preferences among different age groups.

study participants preferred less noticeable elastic ligature colours (41.1%), followed by coloured elastic ligatures (28.5%), transparent elastic ligatures (21%), and no colour preference (9.4%). Elekdag-Turk S et al., found that 55% of their sample preferred coloured elastic ligatures [1], while Tariq A et al., reported that 72% preferred coloured elastic ligatures [3]. The explanation for these differences may lie in the methodologies. Elekdag-Turk S et al., divided the ligatures into less noticeable colours (transparent, white, pearl, and silver) and coloured ligatures [1], while Tariq A et al., divided the ligatures into coloured elastics (including white, pearl, and silver) and transparent [3]. In the current study, the elastics were divided into less noticeable, coloured, transparent, and any of the above.

There was no statistically significant difference between the colour preferences of the genders in the present study. These results were in agreement with Elekdag-Turk S et al., who reported no difference in colour preferences between genders [1]. However, they contradicted Tariq A et al., study, who found a statistically significant difference in colour preferences between genders [3]. These contradictory results may have been due to the differences in the methodologies, as mentioned earlier. Although Alexander's study mentioned that females prefer red [8[, which support Hurlbert AC and Ling Y idea of an evolutionary basis for colour preferences [9]. On the other hand, researchers at Princeton University suggested that biological and cultural factors can influence colour preferences, which can also explain the difference in the results [11].

There were statistically significant differences in the elastic ligature colour preferences between the different age groups (p-value <0.001).The younger participants (18 years of age) preferred colourful elastic ligatures (47.6%), while patients who were in age group 19-25 years old, preferred less noticeable colours (45%). The older age groups reported that they did not have preferred elastic ligature colours. These results were in agreement with the results from the study by Elekdag-Turk S et al., Lee WY et al., found that elders' colour preferences differed from those younger [1,12]. The determinants for colour preference were chroma and lightness attributes for the elder and younger groups, respectively. Tariq A et al., reported no differences between the different ages in their sample [3]; this difference in the results might be because they were not able to detect any differences due to their small sample size (100 participants).

Regarding the distributed questionnaire, most of the patients (44.5%) reported that they felt excited about changing their elastic colours, while 49.8% reported that they did not like changing the colours before certain occasions. The results were in agreement with those of Tariq A et al., [3].

In this study, the patients' most preferred elastic ligature colours were transparent, silver, blue, and grey. The preference for less noticeable colours may be associated with aesthetic concerns about the metal brackets and the desire to make them less visible [1]. One explanation for why the patients selected less noticeable colours over transparent elastics may be because they had been undergoing orthodontic treatment for at least six months, and they may have experienced the food and drink stains that are associated with transparent elastics [5].

To the best of our knowledge, this was the first study to assess the colour preferences among patients attending an orthodontic clinic in Saudi Arabia. Elastic modules are an integral part of fixed appliances. The availability of different colours is important to the patients and their compliance during treatment. Also, knowledge about most popular colours is important to the orthodontists when ordering their materials.

Limitation(s)

The limitation of the current study is that the sample size was small, and it was not including patients younger than 18 years of age.

CONCLUSION(S)

Based on the results of this study, most patients undergoing orthodontic treatment with fixed appliances preferred less noticeable elastic colours. Age was found to affect patients' elastic colour preference, younger patients preferred coloured elastics while older patients preferred less noticeable and transparent elastic ligatures. No differences in colour preference was found between genders. Future multicentric studies with larger sample sizes, including wider age ranges, are recommended with questions for further investigation, like whether they would like to change the colour on each visit, as it was same colour they want every time or different colour.

Acknowledgement

The authors would like to thank the Deanship of Scientific Research at King Saud University for funding this work through research group number RG-1439-54.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jul 15, 2020
- Manual Googling: Oct 29, 2020
- iThenticate Software: Dec 19, 2020 (8%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: As declared above
- 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: **Jul 15, 2020**
Date of Peer Review: **Sep 02, 2020**
Date of Acceptance: **Nov 25, 2020**
Date of Publishing: **Jan 01, 2021**

ANNEXURE-1

Colour Preference of Elastic Ligatures among orthodontic patients

Thank you for participating in this survey, your opinion is very important to us. Please try to answer all questions with your own answer. It will take from you less than 5 min, if interested to know the results, just contact us to send it to you after it is done.

Part 1: personal information:

1 Age:
- ❍ Less than 18 years
- ❍ 19 - 25 years
- ❍ 26 - 35 years
- ❍ More than 36 years

2 Gender:
- ❍ Male
- ❍ Female

3 Nationality:
- ❍ Saudi
- ❍ Non-Saudi

4 Where do you get treated?
- ❍ Private Clinic
- ❍ Academic Institute
- ❍ Governmental Sector

Part 2: patient opinion regarding during orthodontic treatment:

5 Which colour shades of elastic ligatures do you prefer? (You can choose more than one answer)
- ❍ Colourful (red-blue-green-black …etc)
- ❍ Less-noticeable (white- Silver- Pearl)
- ❍ Transparent
- ❍ Any of above

6 Which ligature colour is your favorite? (……)

7 Do you feel excited when ligatures are to be changed?
- ❍ Yes
- ❍ No
- ❍ does not matter

8 **Do you like to change the ligatures colour on each visit?**
- ❍ Yes
- ❍ No
- ❍ does not matter

10 Do you like to have different ligature colours inside your mouth at the same visit?
- ❍ Yes
- ❍ No
- ❍ does not matter

11 Do you like to change the colour of your ligatures before certain occasions such as Eid, Birthday, etc.….?
- ❍ Yes
- ❍ No
- ❍ does not matter

If your answer is YES mention that occasion (……..……..)