Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 2674 - 2679
Received 25 April 2021; Accepted 08 May 2021.

To Compare Different Methods of Shade Matching of Anterior Teeth for Color Evaluation

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ABSTRACT:

Aim: This study aimed to compare four different methods used for shade selection, i.e., visual method, spectrophotometer, digital photography method and chromatcher application. **Material and methods:** 300 participants were selected from the Out Patient Department of conservative and endodontics in Bhojia Dental College and Hospital.Presence of the maxillary right central incisor with no history of any restorative or endodontic procedures was the primary inclusion criterion. The shade of the right maxillary central incisor was determined using all the four shade selection procedures, namely, visual, spectrophotometric, digital photography method and chromatcher application for all the selected participants and were divided into four groups respectively. Data was statistically analysed. **Results:** Results showed the significant difference with spectrophotometer method in comparison to visual and digital photographic method.
Key words:color evaluation,shade selection,spectrophotometer.

INTRODUCTION

As Goldstein says, "Esthetic dentistry is the art of dentistry in its purest form"[(1)] The aim of esthetic dentistry is to replicate natural tooth and achieve morphological, optical and biological acceptance.[(2)] However, patient satisfaction of esthetic restoration is primarily associated with surface and outline form, translucency and color of the artificial teeth.[(3,4)]

Traditionally, shade matching in dentistry was done by visually comparing the color of tooth with standard shade guide tabs, the operator choosing which he/ she seems to be the best or closest match[(5)].Visual color matching is subjective and influenced by a variety of factors. However, this method is not inferior and should not be underrated. More recently, polarization filters have been attached to such light-correcting devices; their primarily role is to reduce reflected light and to allow for a more accurate assessment of the dental translucency.[(6)]

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In order to eliminate the uncontrolled variables during the color matching process, instrumental methods have been developed.[7] Optical electronics and computer technology not only provided objective and rapid color determination but also presented the ability to detect subtle changes in color.[8,9]. Spectrophotometer provides more accurate and precise measurements. Device used in this study is tooth color comparator (ADAE) a digital shade guide which is fast and reliable in shade taking. Day light 5500ºkelvin mode was chosen.

With advancement in the field of dentistry,use of digital camera has been widely adopted. The camera used for this study was a digital single lens reflex camera (1800D, Canon Inc., Tokyo, Japan)and for each picture shade was obtained by using shade mapping software system ClearMatch (Clarity Dental, Salt Lake City, UT)[10]To use this technology, the dentist needs a digital camera, the manufacturer's white and black reference color tabs and a tooth shade guide.[11]In this modern era of technology smartphones cameras are placing DSLR camera and have become prevalent devices. Improving hardware and faster wireless standard have blostered the growth of the smartphone industry. With every new launch of smartphone the camera specifications have also improved to a level which is at par with DSLR camera. The clinical application namely Chromatcher app (I phone compatible) licensed by DMP industry widely used in clinical practice to determine the shade. This application based method of color detection makes the use of phone camera to click picture. Color of the tooth will be calculated in vita classical mode.

On daily basis, dentists are challenged to satisfy the esthetic requirements of the patients. Therefore, the purpose of this study is to obtain accurate shade matching of tooth using conventional visual method, spectrophotometric and photographic method of shade analysis thus achieving correct tooth shade under simulated clinical condition.

METHODOLOGY

A total of 300 Right maxillary central incisor patients were selected for the study with age of 18-35 yrs. Teeth with any discoloration, developmental disorder , teeth with crown and venners were excluded from the study. Shade selection was done four different methods visual method, spectrophotometeric method, digital and chromatcher application.

GROUP1-SPECTROPHOTOMETRIC METHOD

Patient was made to sit on chair.Tooth to be measured was observed carefully,color gradient of the tooth was noted.Once mode of measurement of color chosen, probe tip was kept 0-0.5mm away from tooth. Probe tip was held against the tooth, "start" button was pressed, after hearing short beep result was displayed on the screen and were noted .

GROUP-2 VISUAL METHOD

Visual method was performed using shade matching light which emits day light 5500ºkelvin was chosen.The subject was viewed at eye level by placing shade tab next to selected tooth. For all the subjects, the middle third of right central incisor was selected for evaluation of shade.Based on the corresponding shade tab, suitable shade was noted.

GROUP 3-APPLICATION METHOD

Study was done with same subject using a phone application namelychromatcher app. This application is licensed by DMP dental industry S.A under the terms of apple Inc licensed

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application. The smart phone used for this application was Iphone 7 and pictures were captured using the main back camera.

GROUP 4-DIGITAL CAMERA

Patient was made to sit in upright position.The focus was made on maxillary right central incisor.The picture was clicked using CANON DSLR camera .Camera was mounted on tripod stand for stability and to obtain a clear picture.The image captured by DSLR was kept in JPEG format.The photo was uploaded in the Clear Match and the final shade was obtained through the Clear Match Software System.

RESULT

Reading ofall the shade matching devices were recorded and data was analysed by chi square test. Result showed thatthere was highly a significant difference in the selection of shade guide between Spectrophotometer and Visual methods and no significant difference in the selection of shade guide between ChromatcherAppand Visual methods followed by significant difference in the selection of shade guide between Digital cameraand Visual methods.

Shade guide	**Spectrophotometer Method**		**Visual Method**	
	Frequency of accuracy	Percent	Frequency of accuracy	Percent
A1	63	21.0%	39	13.0%
A2	79	26.3%	115	38.3%
A3	21	7.0%	12	4.0%
B1	65	21.7%	49	16.3%
B2	64	21.3%	83	27.7%
B3	1	0.3%	0	0.0%
C1	6	2.0%	2	0.7%
C2	1	0.3%	0	0.0%
$\chi 2$ value = 21.477, p-value = 0.001*				

Shade guide	**Chromatcher App Method**		**Visual Method**	
	Frequency of accuracy	Percent	Frequency of accuracy	Percent
A1	50	16.7%	39	13.0%
A2	106	35.3%	115	38.3%
A3	9	3.0%	12	4.0%
B1	63	21.0%	49	16.3%
B2	70	23.3%	83	27.7%
B3	1	0.3%	0	0.0%
C1	0	0.0%	2	0.7%
C2	1	0.3%	0	0.0%
$\chi 2$ value = 7.003, p-value = 0.220				

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Shade guide	Spectrophotometer Method		Visual Method		Digital camera		Chromatcher App Method	
	N	%	N	%	N	%	N	%
A1	63	21.0%	39	13.0%	25	8.3%	50	16.7%
A2	79	26.3%	115	38.3%	81	27.0%	106	35.3%
A3	21	7.0%	12	4.0%	54	18.0%	9	3.0%
B1	65	21.7%	49	16.3%	99	33.0%	63	21.0%
B2	64	21.3%	83	27.7%	37	12.3%	70	23.3%
B3	1	0.3%	0	0.0%	4	1.3%	1	0.3%
C1	6	2.0%	2	0.7%	0	0.0%	0	0.0%
C2	1	0.3%	0	0.0%	0	0.0%	1	0.3%

Shade guide	Digital camera		Visual Method	
	Frequency of accuracy	Percent	Frequency of accuracy	Percent
A1	25	8.3%	39	13.0%
A2	81	27.0%	115	38.3%
A3	54	18.0%	12	4.0%
B1	99	33.0%	49	16.3%
B2	37	12.3%	83	27.7%
B3	4	1.3%	0	0.0%
C1	0	0.0%	2	0.7%
$\chi 2$ value = 72.189, p-value = 0.001*				

DISCUSSION

A viewer, a light source, and an object are the trio of essential components whose interaction characterizes the visual observation method. Dagg.et.al observed that if light from its source changes (eg: sunlight under a cover of clouds) , it will also change the light reflected from the object, in which case the actual color perceived by the observer's eye will be different and as according to American dental association the color rendering index (CRI) value which is closer to 100 is standardized as daylight. In the present study, Vita classical shade guide (Vita Zahnfabrik, H.Rauterlimbh and co. KG, Bad Sackingen, Germany) under color corrected fluorescent light with a CRI of 90 were used to evaluate the shade match of right upper maxillary central incisor. Findings by Azad et al 2007 and Corcodel et al favor these lights because they improve shade selection ability of the observer. Though this is the most common method of shade selection, there are many inaccuracies with the use of these commercial shade guides. Preston et al identified various problems with vita shade guide such as the influence of gingiva and the difference in material of shade tabs and ceramics.spectrophotometers came up as an alternative method to meet the clinician's demand.

In the present study color tooth comapactor ADAE was used to provide the required shade for it is known to give fast, precise and reliable shade determination of natural teeth and ceramic restorations in a clinical setup.[12,13]

On comparing spectrophotometric method with the visual method it was found Spectrophotometer showed better results in comparison with the visual methodwhich wasin accordance with Paul et al 2002 in which he concluded that spectrophotometer was more accurate and reliable than other conventional visual shade matching methods.

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Due to significant advancement in digital photography and imaging software, the use of digital camera is now omnipresent in color imaging. It may also include dental documentation, progress and monitoring, communication and marketing. Digital photographs were clicked by using canon 1800 D and pictures were uploaded to clear match software to get the shade.
Results showed that digital method was better in comparisionto visual shade matching. Similar results were found by Jaradet al but smartphone can increase ease of wireless communication between dentist and lab technician. In this study I phone 6 dual main camera helped to capture a detailed picture and chromatcher app was installed in the phone and final shade was recorded and it was found that there was no statistically difference between chromatcher and visual method.

Fig1 – shade selection done using spectrophotometer

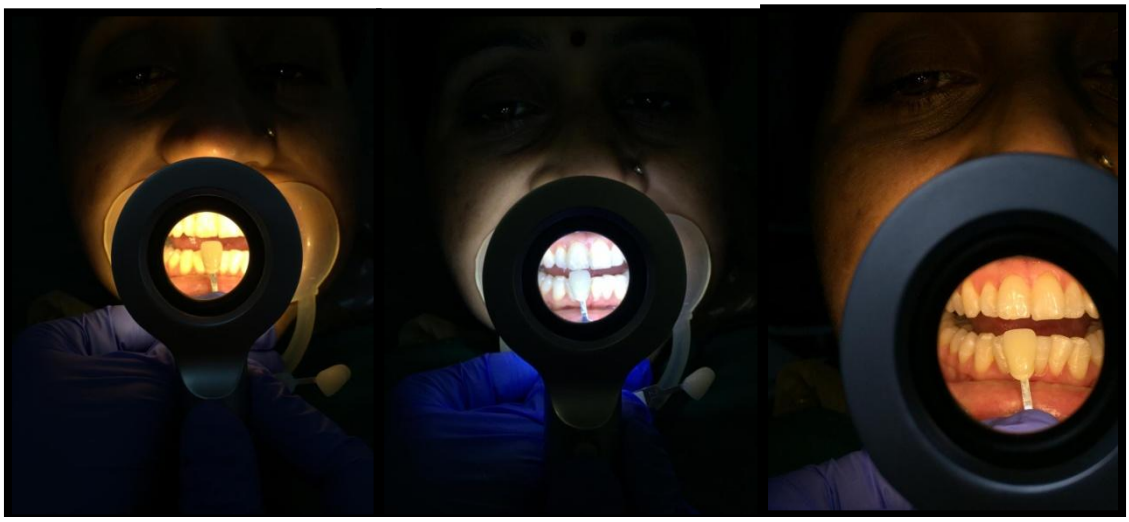
Fig2- shade matching light used which emit light of different intensity.

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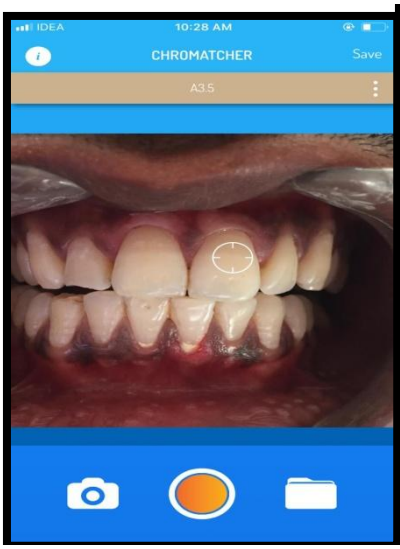

Fig3 – chromatcher application

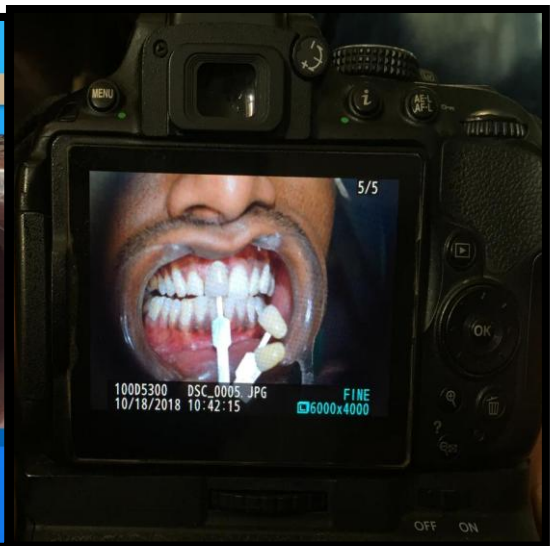

Fig 4- Digital camera

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