Awareness and knowledge of smile analysis and smile arc among orthodontists and non – orthodontists: A knowledge, attitude, and practices survey

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Abstract---The aim of this study was to assess and evaluate the awareness and knowledge of smile arc and analysis among orthodontists and non-orthodontists by means of conducting a knowledge, attitude and practices survey. A closed questionnaire of 17 questions was prepared in consultation with experts involved in the training of dentists. Based on a pilot study a response count of 130 was determined to achieve a power of 80. The questionnaire was shred through professional chat forums. A reminder post was shared two weeks after the initial post. The survey was closed four weeks after the reminder post and 145 responses were obtained. Most respondents were non-orthodontists and were young practitioners with experience of less than 5 years. Descriptive statistics showed that most respondents are aware of smile analysis and smile arc but most

respondents do not use it in practice for diagnosis and treatment planning. Independent t-test showed that orthodontists are more aware of smile arc and smile analysis and use it more often in clinical practice when compared to non-orthodontists. Most participants are aware of the parameters for to be evaluated for smile analysis and smile arc. Although some participants present with a lack of clarity in the factors that affect smile analysis and smile arc.

Keywords---incisor display, orthodontics, smile, smile analysis, smile arc.

Introduction

A smile is regarded as a key component of facial aesthetics and attractiveness. It plays an important role in facial expression and appearance, studies with photographs denote that higher intellectual and social abilities were attributed to individuals with an aesthetic smile[1]. An attractive smile is always an important asset that makes a person feel more confident and more socially appealing[2–4]. According to Dale Carnegie, a smile is considered one of the most important factors to win friends and influencing people. A bad smile could have a negative impact on an individual's life inducing insecurity and lack of confidence, which can affect their personal and professional life[5].

In today's world, patient expectations from orthodontic treatment have evolved from just addressing the malocclusion to a holistic transformation with a paramount emphasis on aesthetics[6]. This sense of aesthetics has seen a spike among the general public, especially among young adults[7]. Smile analysis is an important technique employed to evaluate the smile aesthetically and study the impact of each component in the smile. This tool is an important diagnostic aid and is utilized to base treatment planning decisions. Numerous studies and surveys have assessed smile aesthetics and their perceptions[6,8]. In smile analysis, the parameters which are analysed include lip line, smile arc, upper lip curvature, frontal occlusal plane, lateral negative space, smile symmetry, and dental and gingival components[9,10]. One of the most important among these components is the smile arc. It is the relationship between a hypothetical curve drawn along the edges of the maxillary anterior teeth and the inner contour of the lower lip in the posed smile[11]. The curvature of the incisal edges appears to be more pronounced for women than for men and tends to flatten with age. In an optimal smile arc— described as "consonant"—the curvature of the maxillary incisal edges coincides with or parallels the border of the lower lip in smiling[12]. In a "non-consonant" smile arc, the maxillary incisal edges are either flat or reversed relative to the curvature of the lower lip[7].

The aesthetic considerations are paramount in treatment planning; however, rigid rules cannot be applied to this process because almost an infinite variety of faces could be aesthetic[13]. The literature describes two different types of smiles - spontaneous smile and social smile[14,15]. The spontaneous smile or an involuntary smile is activated as an emotional response and it is non-reproducible. The posed smile or social smile is voluntary, it is static and reproducible. To standardize

evaluation for diagnosis and treatment planning, it has been recommended to consider social smile in orthodontic patients[16–18]. The aesthetics and attractiveness of smiles have also been evaluated subjectively by various authors[19–22]. A smile's aesthetics is a complex interaction between various factors such as teeth, lips, gingival contours, buccal corridor spaces, etc. Although each factor can be considered independently, all the factors act in cohesion to express the final aesthetic outcome of the smile[19,23–27]. The perception of an orthodontist for an aesthetic smile will be different from any other dentist practicing in other specialties of dentistry. Hence, this survey was conducted to evaluate the Awareness and Knowledge of Smile Analysis and Smile Arc Among Orthodontists and Non – Orthodontists.

Materials and Methods

The study was a cross-sectional descriptive survey designed to assess the competency and knowledge of practitioners on smile analysis and smile arc. This study was approved by the institutional review board of Saveetha Dental College and Hospitals, Chennai, Tamil Nadu (SRB/SDC/ORTHO-1904/21/247). The sample size was found to be 130 based on the calculation from the pilot study conducted, with a significance level of alpha=0.05, 80% power. The questionnaire was developed together by both authors and was reviewed by a few consultants involved in the training of dentists. The options of each question were randomly arranged by an investigator who was not involved in collecting the data to minimize the risk of bias.

The survey consisted of 17 close-ended questions. The questionnaire utilized both image-based and multiple- choice questions. To ensure anonymity demographic data such as name, age, and contact details were not collected. The questionnaires were sent to the target population which consisted of orthodontists and non-orthodontists through emails and social media. The data collection was performed through a self-administered web-based questionnaire. The smile photographs were obtained from institutional records and consent for the same was obtained. Consent was also obtained from the participants before they participated in the survey.

The questionnaire was prepared on the online survey platform Google Forms (Alphabet Inc., USA) and the survey participation link was sent out to clinicians using professional chat groups on WhatsApp Messenger (Meta Inc., USA) to a total of five hundred participants. A second invitation was sent out two weeks later to allow participants to respond. The survey was closed two weeks after the second invitation.

The questionnaire was divided into three domains: (1) Demographic data regarding practice and experience, (2) Knowledge of smile analysis and smile arc, and (3) Image-based questions to assess the general perspective of participants to assess ideal smile characteristics. For Domain (1), the questions aim to identify the general information of the experience and the type of practice (Orthodontist or Non-orthodontist), whether the respondent was aware of smile analysis and smile arc, and did they practice smile analysis in their practice. For Domain (2), the questions aimed to assess the respondents' view and knowledge on the various

components of a smile and the impact of these components on a patient's smile. The questions in this domain were in the line of a quiz format. For Domain (3), the respondents were presented with various photographs of different smiles to understand their perspective on assessing smiles and what they considered as an ideal smile.

After the survey was closed the responses from the participants and collected. The master chart was derived from the survey platform and tabulated onto a spreadsheet. The responses were then evaluated. Descriptive analysis and independent t-test were performed using Statistical Package for the Social Sciences (SPSS) version 23 (IBM Corporation., U.S.A.) program to analyse the results.

Results and Discussion

A total of 145 responses were received from both orthodontists and non-orthodontists.

Response Rate and Demographics

One hundred and forty-five responses were received after two invitations to participate, representing a response rate of 29%. Most of the respondents (72%) were non-orthodontists.

Experience

Most participants in the survey were young and beginners with a clinical practice experience of between 0-5 years. 7% of the participants had a clinical practice experience of 5-10 years, 3.5% of participants had a clinical experience of between 10-20 years and 0.7% of the participants had a clinical of more than 20 years.

Knowledge of Smile analysis and arc

- A majority of the participants are aware of and understand the terms smile analysis (78.5%) and smile arc (91%).
- A majority of the participants understand the different types of smile arcs (90.6% can identify a consonant smile arc and 52.6% can correctly identify an inverse smile arc).
- A majority of the participants agree that smile analysis is an integral part of treatment planning (94.5%) but a majority of them do not perform smile analysis (56.3%).
- Only 50% of the participants in the survey replied 'yes' to the question "are you aware of the parameters to be evaluated in the smile analysis?" but 19.4% of the participants responded 'uncertain' to the same question.

The perspective of the participants on parameters that affect smile arc

- 82.1% of the participants considers tooth structure and tonicity of the lower lip to affect smile arc. Although 13.5% are uncertain about the impact of

tooth structure and 14.6% are uncertain about the impact of tonicity of the lower lip on the smile arc.

- 63.2% of the participants consider the elevation of the upper lip has an impact on the smile arc but 17.4% think maybe and 19.4% think that the elevation of the upper lip affects the smile arc.
- 85.3% of participants think that the incisor inclination of the teeth affects the smile arc and 10.5% think maybe.

The image-based questions to assess the perspective of the participants on different smiles
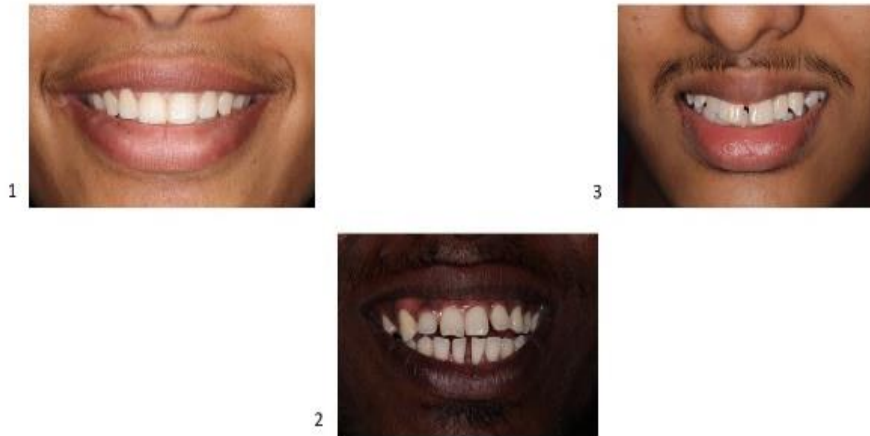
- When asked to select the particular smile which they considered the ideal gingival show (Figure 1), 52.8% selected option 4, 38.7% selected option 3, 6.3% selected option 2, and 2.1% selected option 1.

Which smile do you think has the ideal gingival show?

Figure 1 – Image based question number 1 to assess perspective of participants on different smiles – participants are presented with images to assess gingival show

- When asked to select the particular smile which they considered had the ideal amount of incisor exposure (Figure 2), 84.1% of the participants selected option 1, 6.4% selected option 2, and 9.8% selected option 3.

In which photo do you think is incisor exposure adequate?

Figure 2 – Image based question number 2 to assess perspective of participants on different smiles – participants are presented with images to assess adequacy incisor exposure

- When asked to select the particular smile which they considered had the ideal smile (Figure 3), 54.5% selected option 1, 25.2% selected option 2, 8.4% selected option 3, 7.7% selected option 6, 2.8% selected option 5, and 1.4% selected option 4.

Which do you think is the most ideal smile?

(Figure 3) – Image based question number 3 to assess perspective of participants on different smiles – participants are presented with images to select what they consider an ideal smile

The independent t-test highlighted orthodontists were more aware of the parameters to be evaluated and utilized smile analysis for treatment planning. The test also showed that orthodontists better understood the term smile arc and regularly evaluated it during the treatment planning phase ($p<0.05$).

Smile analysis is regarded as an important tool while planning any treatment in orthodontics. Smile arc is regarded as an important component of smile aesthetics. The findings of Camara[28], Machado[29], and Kadhim et al[30]concur with this assessment. However, a systematic review by Janson et al disagrees with this assessment[31]. Achieving optimal facial aesthetics is one of the primal objectives of orthodontic treatment and it forms the crux in today's digital world[32]. The investigation by Kiyak[33] concluded that aesthetics change post orthodontic treatment is the primary motive for patients in seeking orthodontic treatment eclipsing the improvement in oral function and health. The physical improvements in the smile go a long way as its improvement in the psychosocial well-being of the patient and boost in morale cannot be understated[21,34–38].

Several authors agree that a consonant smile arc is necessary for smile aesthetics[11,39–45]. An optimal smile arc is described as "consonant" and is one where the curvature of the maxillary incisal edges coincides with or parallels the border of the lower lip during a smile. Thus, the pattern of smile arc present pre-treatment has to be evaluated and[46–49] careful consideration must be made during treatment planning. A one-size-fits-all approach must be avoided[46–49]. Another aspect that is directly affected by the level of smile arc is the perception of age, patients with consonant smile arcs tend to look younger[29] and those with a non-consonant smile arc tend to look older[50,51].

Although an overwhelming majority of respondents of this survey consider smile analysis an integral part of treatment planning, 56.3% of the participants do not perform smile analysis in practice. 91% of respondents in this survey were correctly able to identify a consonant smile arc and 53% were able to distinguish between inverse, consonant, and non-consonant smile arcs. In this survey, we also observed that the majority of the participants have similar perspectives on smile characteristics. Another observation was that there were some uncertainties among the participants about the parameters to be assessed for smile arc and smile analysis and the impact of these parameters on smile analysis and smile arc. The results also showed that orthodontists were more aware of smile analysis and smile arc and also utilized them more in treatment planning.

Conclusion

Most participants are aware of smile analysis and smile arc. Orthodontists seem to have more awareness of the analysis and have responded to using it in regular clinical practice for diagnosis and treatment planning. There exists some confusion among the participants regarding the parameters and factors that impact smile arc.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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