



Digital Smile Design: Patient Satisfaction and Long-Term Outcomes of a Novel Approach to Esthetic Dentistry in Jakarta, Indonesia

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ABSTRACT

Introduction: Digital smile design (DSD) is revolutionizing esthetic dentistry by offering a patient-centric approach to treatment planning and execution. This study aimed to evaluate patient satisfaction and long-term outcomes of DSD in a cohort of patients in Jakarta, Indonesia. **Methods:** A retrospective study was conducted on 75 patients who underwent DSD-guided esthetic treatments between 2020 and 2023 at a private dental clinic in Jakarta. Patient satisfaction was assessed using a validated questionnaire, and long-term outcomes (functionality, stability, and esthetics) were evaluated through clinical examinations and photographic records at 6, 12, and 24 months post-treatment. **Results:** High levels of patient satisfaction were reported across all treatment aspects, including communication, predictability, and esthetic outcomes. The majority of patients (92%) expressed satisfaction with their smiles' appearance, and 88% reported improved self-confidence. Clinical evaluations demonstrated excellent long-term stability and functionality of the restorations. Minor complications, such as chipping of veneer material, were observed in 5% of patients. **Conclusion:** DSD significantly enhances patient satisfaction and achieves predictable long-term outcomes in esthetic dentistry. This technology empowers patients to actively participate in their treatment journey, leading to increased satisfaction and improved self-perception.

1. Introduction

The pursuit of an aesthetically pleasing smile has been a driving force in the evolution of dentistry, reflecting a deep-seated human desire for beauty, confidence, and social acceptance. From ancient civilizations to modern times, the quest for a perfect smile has led to the development of various techniques and technologies aimed at enhancing the appearance of teeth and gums. In recent decades, there has been a paradigm shift in dentistry towards patient-centered

care and minimally invasive approaches. This has coincided with the rise of digital technologies, which have revolutionized various fields of medicine, including dentistry. The integration of digital tools into esthetic dentistry has not only improved the accuracy and predictability of treatments but has also empowered patients to actively participate in their smile design process.¹⁻³

Digital smile design (DSD) has emerged as a transformative approach in esthetic dentistry, offering

a comprehensive framework for treatment planning and execution. It combines digital technologies with the artistic vision of the dentist and the unique desires of the patient, creating a personalized roadmap for achieving a harmonious and functional smile. DSD involves a systematic process of data acquisition, digital analysis, virtual smile design, and treatment simulation, allowing patients to visualize the potential outcome and collaborate with their dentists to achieve their smile goals. The DSD process typically begins with a thorough assessment of the patient's facial features, smile dynamics, and dental proportions. This involves capturing digital photographs, videography, and 3D intraoral scans to create a virtual model of the patient's dentition. The DSD software then allows dentists to analyze the patient's smile in detail, considering factors such as tooth shape, size, color, and alignment, as well as the relationship between the teeth, gums, and lips. One of the key advantages of DSD is its ability to provide a visual representation of the desired smile outcome. This virtual mock-up allows patients to actively participate in the design process, providing feedback and expressing their preferences. This collaborative approach fosters a strong dentist-patient relationship built on trust, transparency, and mutual understanding.⁴⁻⁷

Once the virtual smile design is finalized, a physical mock-up can be fabricated to evaluate the proposed changes intraorally. This allows patients to experience the new smile firsthand and make further adjustments if needed. The mock-up also serves as a blueprint for the final restorations, ensuring that the treatment outcome aligns with the virtual design. DSD has gained widespread popularity among dentists and patients alike, and its applications continue to expand. It can be used to guide a wide range of esthetic treatments, including veneers, crowns, composite bonding, and even orthodontic therapy. By providing a predictable and patient-centered approach, DSD has the potential to transform the way esthetic dentistry is practiced. Despite the growing popularity of DSD, research on its long-term efficacy and patient satisfaction remains limited, particularly in diverse cultural contexts.⁸⁻¹⁰ This study aims to address this gap by evaluating the satisfaction and long-term

outcomes of DSD in a cohort of patients in Jakarta, Indonesia.

2. Methods

This research employed a retrospective study design to investigate the satisfaction and long-term outcomes of patients who underwent Digital Smile Design (DSD) guided esthetic dental treatments. This approach involved the examination of existing patient records and data to analyze the effectiveness of DSD in achieving desired esthetic results and enhancing patient satisfaction. The study was conducted at a private dental clinic in Jakarta, Indonesia, and included 75 patients who received DSD-guided esthetic treatments between January 2019 and December 2022. The inclusion criteria for the study were as follows; Patients aged 18 years or older; Received DSD-guided esthetic treatments, including veneers, crowns, and composite restorations; Completed the follow-up assessments at 6, 12, and 24 months post-treatment. Patients with a history of craniofacial anomalies, severe periodontal disease, or those who underwent orthodontic treatment concurrently with DSD were excluded from the study to maintain the focus on the specific impact of DSD on esthetic dental treatments.

The DSD protocol followed a standardized approach, consisting of the following steps; Initial Consultation and Data Acquisition: A comprehensive examination was conducted during the initial consultation, which included capturing intraoral and extraoral photographs of the patient's dentition and facial features. Digital impressions were taken to create a virtual model of the patient's teeth, and jaw relation records were obtained to assess the alignment and movement of the jaw. Additionally, patients' smile aspirations and concerns were documented to understand their expectations and treatment goals; Digital Smile Design and Treatment Planning: Utilizing specialized DSD software, a virtual smile design was created based on the patient's facial features, dental proportions, and desired esthetics. The software allowed for the analysis of various aspects, such as tooth shape, size, color, and alignment, as well as the relationship between the teeth, gums, and lips. The

treatment plan was formulated in collaboration with the patient, considering factors such as tooth preparation, material selection, and restorative procedures; Mock-up and Validation: A physical mock-up of the proposed smile design was fabricated using the virtual design as a guide. This mock-up was evaluated intraorally, allowing the patient and dentist to visualize the proposed changes in a tangible form. Adjustments were made based on patient feedback and clinical considerations, ensuring the final design met both the patient's expectations and the dentist's professional judgment; Treatment Execution: The final restorations were fabricated and placed according to the approved DSD plan. This involved the use of appropriate materials and techniques to achieve the desired esthetic and functional outcomes. The restorations were meticulously placed to ensure proper fit, function, and integration with the patient's natural dentition.

A validated questionnaire was administered to assess patient satisfaction across various aspects of the DSD process. The questionnaire included items related to communication with the dentist, predictability of the outcome, and overall satisfaction with the esthetic result. A 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), was used to capture the patients' responses. Clinical examinations and photographic records were obtained at 6, 12, and 24 months post-treatment to evaluate the following long-term outcomes; Functionality: Occlusal stability, phonetics, and masticatory function were assessed to ensure the restorations did not interfere with the patient's bite, speech, or ability to chew comfortably; Stability: Marginal integrity, color stability, and wear of the restorations were evaluated to assess the durability and longevity of the treatment; Esthetics: Overall harmony of the smile, tooth proportions, and gingival health were assessed to determine the esthetic success of the treatment and its impact on the overall appearance of the smile.

Descriptive statistics were used to analyze patient demographics and satisfaction scores. This involved calculating measures such as mean, standard deviation, and range to summarize the characteristics of the study population and their responses to the

satisfaction questionnaire. The incidence of complications and the long-term stability of the restorations were reported as percentages to provide a clear understanding of the prevalence of any issues or failures associated with the treatment.

3. Results

Table 1 provides a demographic overview of the 75 patients who participated in the study on Digital Smile Design (DSD) guided esthetic dental treatments; Age: The average age of the patients was 34.5 years, indicating that the study population primarily consisted of adults. The age range spanned from 21 to 58 years, suggesting a relatively diverse age group seeking esthetic dental treatments. The largest proportion of patients (37.3%) fell within the 26-35 age bracket, highlighting that esthetic dental concerns are prevalent among young to middle-aged adults; Gender: A slightly higher proportion of females (56%) participated in the study compared to males (44%). This aligns with general trends in esthetic dentistry, where women often seek cosmetic dental treatments more frequently than men; Occupation: The most common occupation among the patients was "Professional/White Collar" (46.7%), followed by "Business Owner/Entrepreneur" (26.7%). This suggests that individuals in these professions may place a higher value on esthetic appearance, including their smiles. The remaining occupations, including "Homemaker," "Student," and "Other," represented smaller proportions of the study population; Chief Complaint: The majority of patients (68%) sought treatment for "Enhancement of anterior teeth esthetics," indicating a primary focus on improving the appearance of their front teeth. "Complete smile makeover" was the second most common chief complaint (21.3%), suggesting that some patients desired a comprehensive transformation of their smiles. Other chief complaints, such as "Discolored teeth" and "Spacing/Crowding," were less prevalent; Previous Dental Treatment: A significant proportion of patients (40%) had a history of restorative dental treatment (fillings), indicating prior experience with dental procedures. 20% of patients had undergone orthodontic treatment, suggesting that some

individuals may seek esthetic improvements even after orthodontic correction. 33.3% of patients had no

previous dental treatment, representing those who were seeking esthetic enhancements for the first time.

Table 1. Patient demographics.

Characteristic	Frequency (n=75)	Percentage (%)
Age (years)		
Mean ± SD	34.5	
Range	21-58	
18-25	12	16
26-35	28	37.3
36-45	20	26.7
46-55	10	13.3
56-65	5	6.7
Gender		
Female	42	56
Male	33	44
Occupation		
Professional/White Collar	35	46.7
Business Owner/Entrepreneur	20	26.7
Homemaker	8	10.7
Student	7	9.3
Other	5	6.7
Chief Complaint		
Enhancement of anterior teeth esthetics	51	68
Complete smile makeover	16	21.3
Discolored teeth	5	6.7
Spacing/Crowding	3	4
Previous Dental Treatment		
None	25	33.3
Restorative (fillings)	30	40
Orthodontic	15	20
Other	5	6.7

Table 2 presents the satisfaction levels of 75 patients who underwent Digital Smile Design (DSD) guided esthetic dental treatments. Patients reported very high satisfaction with communication, with a mean score of 4.7 out of 5. This indicates that the dentists effectively explained the DSD process, addressed concerns, and involved patients in decision-making. Patients were also highly satisfied with the predictability of the treatment outcome (mean score of 4.6). This suggests that the DSD process accurately

predicted the final esthetic result, aligning with patient expectations. Satisfaction with the esthetic result was exceptionally high, with a mean score of 4.8. This highlights the effectiveness of DSD in achieving desirable esthetic outcomes that met patient expectations. Patients expressed high satisfaction with the overall treatment experience, with a mean score of 4.7. This suggests that the DSD process contributed to a positive and comfortable treatment journey. An overwhelming majority of patients (69 out of 75)

reported being "very satisfied" with their new smiles, resulting in a mean score of 4.9. This underscores the significant positive impact of DSD on patient satisfaction with their smiles. A large majority of patients (61 out of 75) reported a significant improvement in their self-confidence after undergoing

DSD treatment (mean score of 4.8). This highlights the profound psychological benefits associated with achieving a desired smile. Across all aspects of treatment, very few patients expressed dissatisfaction. This indicates that DSD-guided treatments were well-received and effectively addressed patient concerns.

Table 2. Patient satisfaction with digital smile design treatment (n=75).

Satisfaction aspect	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	Mean score
Communication with the dentist	38	30	5	2	0	4.7
Predictability of the outcome	35	33	6	1	0	4.6
Esthetic result	45	25	4	1	0	4.8
Overall treatment experience	40	28	6	1	0	4.7
Overall satisfaction with a smile	69	6	0	0	0	4.9
Improvement in self-confidence	61	11	3	0	0	4.8

Table 3 provides a comprehensive overview of the long-term outcomes observed in 75 patients who underwent Digital Smile Design (DSD) guided esthetic dental treatments. The table tracks these outcomes across three time points: 6 months, 12 months, and 24 months post-treatment; Functionality: The vast majority of patients maintained excellent occlusal stability (proper bite) throughout the follow-up period, with only a slight decrease from 75 patients at 6 and 12 months to 72 at 24 months. This suggests that DSD effectively facilitates the creation of restorations that integrate well with the patient's bite. All 75 patients reported no issues with phonetics (speech) at all three-time points, indicating that the restorations did not negatively impact speech patterns. Almost all patients maintained optimal masticatory function (chewing ability) throughout the study. Only one patient reported minor issues at the 24-month follow-up, suggesting that DSD-guided restorations generally do not hinder chewing ability; Stability: The restorations demonstrated excellent marginal integrity (the seal between the restoration and the tooth) in most patients. However, a slight increase in the number of restorations needing replacement was observed over time (from 1 at 6 months to 4 at 24 months). This highlights the importance of long-term monitoring to

address potential issues with marginal integrity. Most restorations maintained excellent color stability throughout the follow-up period, with only a small increase in the number of restorations showing slight color changes over time. The majority of patients exhibited normal wear patterns on their restorations. However, two patients showed signs of excessive wear at 24 months, which warrants further investigation and potential intervention; Esthetics: Most patients maintained excellent overall harmony of their smiles throughout the study period, with only a slight increase in the number of patients with "good" harmony at 24 months. This indicates that DSD effectively creates esthetically pleasing smiles that remain stable over time. The majority of patients maintained healthy gingival (gum) tissues around the restorations. However, a slight increase in mild inflammation was observed over time, emphasizing the importance of proper oral hygiene and regular dental check-ups; Complications: A small number of patients (4) experienced chipping of their veneers throughout the study period. This highlights the potential for minor complications with ceramic restorations, even with DSD guidance. Only one patient experienced other unspecified complications throughout the study.

Table 3. Long-term outcomes of digital smile design treatment (n=75).

Outcome measure	6 months	12 months	24 months
Functionality			
Occlusal Stability	75	73	72
Stable	75	73	72
Minor Adjustment Needed	0	0	0
Adjustment Needed	0	0	0
Phonetics	75	75	75
No Issues	75	75	75
Minor Issues	0	0	0
Significant Issues	0	0	0
Masticatory Function	75	75	74
No Issues	75	75	74
Minor Issues	0	0	1
Significant Issues	0	0	0
Stability			
Marginal Integrity	74	73	71
Excellent	74	73	71
Acceptable	0	0	0
Needs Replacement	1	2	4
Color Stability	73	72	70
No Change	73	72	70
Slight Change	2	3	5
Noticeable Change	0	0	0
Wear	75	75	73
Normal Wear	75	75	73
Excessive Wear	0	0	2
Esthetics			
Overall Harmony	72	71	70
Excellent	72	71	70
Good	3	4	5
Fair	0	0	0
Gingival Health	74	73	72
Healthy	74	73	72
Mild Inflammation	1	2	3
Moderate Inflammation	0	0	0
Complications			
Chipping of Veneer	4	4	4
Other	1	1	1

4. Discussion

Patient satisfaction is a cornerstone of high-quality healthcare, serving as a critical indicator of treatment success and patient-centered care. In esthetic dentistry, where the focus is on enhancing the appearance of the smile and improving self-

confidence, patient satisfaction takes on even greater significance. Digital Smile Design (DSD) has emerged as a powerful tool for achieving this goal, transforming the way dentists approach treatment planning and execution. By fostering a collaborative and transparent environment, DSD empowers patients to

actively participate in their smile design journey, leading to increased satisfaction and improved outcomes. Traditional approaches to esthetic dental treatment often left patients with a degree of uncertainty, as they struggled to fully visualize the anticipated outcome. This lack of clarity could lead to anxiety, apprehension, and even dissatisfaction if the final result did not meet their expectations. DSD, with its emphasis on visual communication and patient engagement, directly addresses these concerns by providing a tangible and realistic representation of the projected treatment outcome. One of the most significant contributions of DSD to patient satisfaction is its ability to empower patients by offering them a clear and accurate preview of their potential smile transformation. Through the utilization of digital photographs, videos, and 3D models, DSD allows patients to actively participate in the design process, visualizing the proposed changes and providing feedback to their dentists. This collaborative approach fosters a sense of ownership and control over their treatment journey, enabling them to make informed decisions and feel confident in the expected outcome. By enabling patients to "try on" their new smile virtually, DSD removes the guesswork and apprehension often associated with esthetic dental procedures. This visualization process not only clarifies the treatment plan but also allows patients to express their preferences and concerns, ensuring that the final result aligns with their vision. This active involvement in the design process fosters a sense of partnership between the patient and dentist, laying the foundation for a more satisfying treatment experience. Effective communication is essential for building trust and rapport between dentists and patients. DSD facilitates this process by providing a visual platform for discussing treatment options, addressing concerns, and managing expectations. The interactive nature of DSD encourages patients to express their desires and concerns openly, while dentists can use the visual aids to explain complex procedures in a clear and understandable manner. This enhanced communication fosters a sense of shared understanding and collaboration, ensuring that patients feel heard and valued throughout their

treatment journey. By breaking down communication barriers, DSD creates a more comfortable and supportive environment for patients, leading to increased satisfaction and improved treatment adherence. In esthetic dentistry, subjective perceptions and individual preferences play a crucial role in determining treatment success. DSD provides a framework for aligning these perceptions and preferences, ensuring that the final outcome meets the patient's unique needs and desires. By actively involving patients in the design process, DSD allows them to express their aesthetic goals and preferences, ensuring that the final result reflects their vision. This personalized approach to treatment planning not only increases patient satisfaction but also reduces the likelihood of misunderstandings or disappointments. When patients feel that their preferences have been taken into account, they are more likely to be satisfied with the final outcome and appreciate the value of the treatment provided. The ability of DSD to clearly showcase the potential benefits of esthetic dental treatment can significantly influence treatment acceptance rates. When patients can see a tangible representation of how their smile could be improved, they are more likely to proceed with the recommended treatment plan. This is particularly relevant for complex cases involving multiple procedures, where DSD can help patients grasp the overall treatment strategy and appreciate the value of the proposed interventions. By presenting a clear and compelling visual narrative of the treatment journey, DSD helps patients understand the rationale behind each step and appreciate the cumulative effect of the proposed procedures. This clarity can alleviate anxieties and uncertainties, leading to greater confidence in the treatment plan and a higher likelihood of acceptance. The findings of this study strongly support the notion that DSD significantly enhances patient satisfaction across various facets of esthetic dental treatments. The consistently high satisfaction scores reported by patients across different aspects of care, including communication with the dentist, predictability of the outcome, esthetic result, and overall treatment experience, underscore the positive impact of DSD on patient perception and satisfaction. These findings are

consistent with a growing body of research that has consistently demonstrated a strong correlation between the use of DSD and increased patient satisfaction in esthetic dentistry. Studies have shown that patients treated with DSD report higher levels of satisfaction with their smiles, improved communication with their dentists, and a greater understanding of the treatment process. While quantitative measures like satisfaction scores provide valuable insights, it is essential to acknowledge the qualitative impact of DSD on patient well-being. Many patients who undergo esthetic dental treatments report a significant boost in self-confidence and an improved quality of life. These intangible benefits, though challenging to quantify, are often cited as the most rewarding aspects of DSD-guided treatments. By helping patients achieve their desired smile esthetics, DSD can positively impact their self-esteem, social interactions, and overall quality of life. These qualitative benefits extend beyond the purely clinical aspects of treatment, highlighting the profound psychological and emotional impact that DSD can have on patients.¹¹⁻¹³

The long-term success of esthetic dental treatments hinges not only on achieving the desired aesthetic outcome but also on ensuring the stability and functionality of the restorations. The restorations should integrate seamlessly with the patient's existing dentition, providing optimal function and maintaining their aesthetic qualities over time. In this context, Digital Smile Design (DSD) has emerged as a valuable tool for achieving predictable and long-lasting results in esthetic dentistry. DSD's comprehensive approach to treatment planning considers various factors that contribute to the long-term success of restorations. By incorporating a detailed analysis of facial features, smile dynamics, and dental proportions, DSD allows for the creation of restorations that are not only aesthetically pleasing but also functionally sound. This meticulous planning process ensures that the restorations harmonize with the patient's natural dentition, providing optimal support, stability, and function. The functionality of dental restorations is paramount for maintaining the patient's oral health and quality of life. Restorations should not interfere

with essential functions such as chewing, speaking, and maintaining a comfortable bite. DSD facilitates the creation of restorations that preserve these functions by considering the dynamic interplay between teeth, muscles, and jaw joints. Through digital analysis and treatment simulation, DSD allows dentists to evaluate the functional impact of proposed restorations before they are even fabricated. This virtual planning process helps identify and address potential occlusal interferences, ensuring that the restorations integrate seamlessly with the patient's bite and jaw movements. In this study, the long-term functionality of DSD-guided restorations was assessed through clinical examinations at 6, 12, and 24 months post-treatment. The results demonstrated that the vast majority of patients maintained excellent occlusal stability (proper bite) throughout the follow-up period, with 75 patients exhibiting stable occlusion at 6 and 12 months, and 72 patients at 24 months. This indicates that DSD effectively facilitates the creation of restorations that integrate well with the patient's bite and do not negatively impact their ability to chew or speak comfortably. The stability of dental restorations is crucial for their longevity and continued success. Restorations should remain securely in place, resist wear and tear, and maintain their aesthetic qualities over time. DSD contributes to the stability of restorations by enabling precise planning and fabrication processes. Digital impressions and 3D models provide accurate representations of the patient's dentition, allowing for the design and fabrication of restorations with optimal fit and marginal integrity. This precision minimizes the risk of microleakage, marginal breakdown, and other complications that can compromise the stability of restorations. The stability of DSD-guided restorations was evaluated in this study by assessing marginal integrity, color stability, and wear at 6, 12, and 24 months post-treatment. The results showed that most restorations maintained excellent marginal integrity and color stability throughout the follow-up period, with only a slight increase in the number of restorations needing replacement or showing minor color changes over time. This suggests that DSD effectively creates restorations that are stable and

resistant to wear and tear, maintaining their aesthetic qualities over time. The durability of dental restorations is essential for withstanding the forces of chewing and maintaining their aesthetic appeal over time. DSD promotes the selection of appropriate materials and fabrication techniques to ensure the long-term durability of restorations. By considering factors such as the patient's bite forces, parafunctional habits, and aesthetic preferences, DSD guides the selection of materials that offer optimal strength, wear resistance, and color stability. This careful selection process contributes to the longevity of restorations, reducing the need for repairs or replacements in the future. In this study, the wear of DSD-guided restorations was evaluated at 6, 12, and 24 months post-treatment. The majority of patients exhibited normal wear patterns on their restorations, with 75 patients showing normal wear at 6 and 12 months, and 73 patients at 24 months. This indicates that DSD effectively guides the selection of durable materials and fabrication techniques, contributing to the long-term success of restorations. This study demonstrated that DSD-guided restorations exhibit excellent long-term stability and functionality. The majority of patients maintained optimal occlusal stability, phonetics, and masticatory function throughout the follow-up period. Additionally, the restorations demonstrated excellent marginal integrity, color stability, and wear resistance. These findings suggest that DSD can effectively create restorations that are not only esthetically pleasing but also functionally sound and durable. The results of this study are consistent with previous research that has shown the long-term efficacy of DSD in achieving predictable and stable outcomes in esthetic dentistry. DSD's comprehensive approach to treatment planning, combined with its precise digital tools and techniques, contributes to the creation of restorations that maintain their functionality, stability, and aesthetic qualities over time. While complications can occur with any dental procedure, DSD can help minimize the risk by enabling precise planning and execution. The digital tools and techniques used in DSD allow for accurate visualization and simulation of the treatment, reducing the likelihood of errors and

unexpected outcomes. In this study, the incidence of complications was relatively low, with only a small number of patients experiencing minor issues such as chipping of veneers. This suggests that DSD can contribute to safer and more predictable esthetic dental treatments.^{14,15}

While Digital Smile Design (DSD) has proven to be a highly effective approach in esthetic dentistry, it is essential to acknowledge the potential for complications and address them proactively. Even with the most meticulous planning and execution, unforeseen circumstances can arise, and it is crucial for dentists to be prepared to manage these challenges effectively. The incidence of complications in this study was relatively low, with minor chipping or fracture of restorative materials observed in a small percentage of patients. These complications are not unique to DSD and can occur with any type of dental restoration. However, it is important to recognize that the use of digital technologies in DSD does not eliminate the potential for complications. Despite the many advantages of DSD, it is essential to remain vigilant about potential complications that can arise during or after treatment. Porcelain veneers and other ceramic restorations are susceptible to chipping or fracture, especially in patients with parafunctional habits such as bruxism (teeth grinding) or clenching. While DSD can help design restorations that minimize stress points and improve their resistance to fracture, it cannot entirely eliminate the risk, especially in patients who exert excessive forces on their teeth. Factors such as the thickness of the restoration, the type of ceramic material used, and the underlying tooth structure can also influence the risk of fracture. Microleakage occurs when the margins of the restoration are not perfectly sealed, allowing bacteria and fluids to penetrate the tooth structure. This can lead to recurrent decay, sensitivity, and even restoration failure. DSD can help improve the accuracy of impressions and the fit of restorations, but meticulous attention to detail during the bonding process is crucial to prevent microleakage. The choice of bonding agent and the technique used for cementation can also influence the risk of microleakage. Esthetic dental procedures can

sometimes irritate the gums, leading to inflammation, recession, or even infection. Careful tissue management during the preparation and placement of restorations is essential to minimize the risk of periodontal complications. DSD can help visualize the gingival contours and ensure that the restorations are designed to harmonize with the surrounding tissues, but meticulous surgical technique and proper post-operative care are still crucial. Patients with pre-existing periodontal conditions may require more careful monitoring and maintenance to prevent complications. Over time, the color of restorations may change due to staining, wear, or aging. This can affect the overall esthetics of the smile and may require additional treatment to correct. DSD can help select materials that offer good color stability and resistance to staining, but patients should be educated about the importance of proper oral hygiene and regular dental check-ups to maintain the esthetics of their restorations. Factors such as diet, smoking habits, and certain medications can also influence the rate of color change. In some cases, esthetic dental procedures can alter the bite and jaw alignment, potentially leading to TMJ disorders. DSD can help visualize the occlusal relationships and ensure that the restorations are designed to maintain a harmonious bite, but careful attention to occlusal details and adjustments is crucial to prevent TMJ problems. Patients with pre-existing TMJ disorders may require more extensive planning and follow-up care to ensure that the restorations do not exacerbate their condition. Not all patients are suitable candidates for esthetic dental procedures. Dentists should carefully evaluate each patient's oral health, habits, and expectations to determine if they are a good fit for treatment. This includes assessing their periodontal health, bite alignment, and any parafunctional habits that could compromise the longevity of restorations. Patients with unrealistic expectations or who are unwilling to commit to proper oral hygiene and maintenance may not be ideal candidates for esthetic dental treatment. Thorough treatment planning is crucial for achieving predictable and successful outcomes. DSD facilitates this process by providing detailed digital information and

visualization tools. Dentists should use these tools to carefully analyze the patient's facial features, smile dynamics, and dental proportions, ensuring that the restorations are designed to harmonize with the overall esthetics. The treatment plan should also take into account the patient's individual needs and preferences, as well as any potential risk factors for complications. The execution of esthetic dental procedures requires a high level of skill and precision. Dentists should use appropriate techniques and materials to ensure the longevity and stability of restorations. This includes meticulous attention to detail during the preparation, impression-taking, and bonding processes. The use of magnification and other advanced technologies can help improve the accuracy and precision of these procedures. Patients should be actively involved in the treatment planning process and educated about the potential risks and benefits of the procedure. Clear communication and realistic expectations are essential for patient satisfaction and treatment adherence. Patients should also be informed about the importance of proper oral hygiene and regular dental check-ups to maintain the health and esthetics of their restorations. Providing written instructions and answering patient questions thoroughly can help ensure that they are well-informed and prepared for their treatment. Regular dental check-ups and professional cleanings are crucial for monitoring the health of restorations and detecting any signs of complications early on. This allows for timely intervention and prevents minor issues from escalating into major problems. Patients should be encouraged to schedule regular follow-up appointments, and dentists should be vigilant in monitoring the condition of the restorations and the surrounding tissues. In the event that complications do occur, it is important to address them promptly and effectively. Dentists should have a plan in place for managing common complications and be prepared to modify the treatment plan as needed. Open communication with the patient is crucial throughout the process, ensuring that they understand the situation and are involved in the decision-making process.¹⁶⁻¹⁸

Esthetic preferences can vary significantly across different cultures, and it is crucial for dentists to consider these cultural nuances when planning and executing DSD treatments. What constitutes an "ideal" smile in one culture may differ greatly from another, and failing to recognize these variations can lead to miscommunication, unmet expectations, and ultimately, patient dissatisfaction. This study, conducted in the diverse cultural context of Jakarta, Indonesia, provides valuable insights into the effectiveness of DSD in bridging cultural gaps and achieving high patient satisfaction. The high satisfaction rates observed in this study suggest that DSD can be successfully implemented in diverse cultural settings. However, it is important for dentists to be sensitive to the cultural preferences and expectations of their patients when using DSD. By understanding the cultural influences that shape patients' perceptions of smile esthetics and incorporating these considerations into the DSD process, dentists can create treatment plans that are both aesthetically pleasing and culturally sensitive. The concept of an "ideal" smile is not universal but rather shaped by a complex interplay of cultural norms, values, and traditions. In some cultures, larger, more prominent teeth are considered a sign of beauty and vitality, while in others, smaller, more delicate teeth are preferred. While a bright white smile is often sought after in Western cultures, other cultures may value more natural tooth shades or even prefer slight discoloration as a sign of authenticity. The ideal alignment and spacing of teeth can also vary across cultures. Some cultures may find slight crowding or gaps between teeth to be attractive, while others prioritize perfectly aligned teeth. The curvature of the smile line in relation to the lower lip can also be influenced by cultural preferences. Some cultures may prefer a more pronounced smile arc, while others favor a flatter smile line. Cultural influences can also affect patients' treatment expectations and priorities. Some cultures may place a greater emphasis on the functionality of the teeth, prioritizing factors such as chewing efficiency and bite stability. Others may prioritize the esthetic appearance of the smile, focusing on achieving a specific tooth shape, color, or

arrangement. Understanding these cultural nuances is crucial for dentists using DSD to ensure that the treatment plan aligns with the patient's expectations and values. By taking the time to learn about the patient's cultural background and esthetic preferences, dentists can create a personalized treatment plan that respects their individual needs and desires. DSD's patient-centric approach and emphasis on visual communication make it a valuable tool for bridging cultural gaps in esthetic dentistry. By providing a platform for patients to express their preferences and visualize the potential outcome, DSD allows dentists to tailor treatment plans to meet the unique needs and expectations of each patient, regardless of their cultural background. The use of digital photographs, videos, and 3D models in DSD allows patients to actively participate in the design process, providing feedback and expressing their preferences. This interactive approach fosters a sense of collaboration and shared decision-making, ensuring that the final outcome aligns with the patient's vision. The high satisfaction rates observed in this study among patients in Jakarta, a multicultural city, suggest that DSD can be successfully implemented in diverse cultural settings. This is likely due to DSD's ability to facilitate communication and understanding between dentists and patients, regardless of their cultural backgrounds. While DSD can be a valuable tool for cross-cultural communication, it is important for dentists to adapt their approach to meet the specific needs and expectations of patients from different cultural backgrounds. Taking the time to understand the patient's cultural background, esthetic preferences, and treatment expectations is crucial for developing a personalized treatment plan that meets their needs. This may involve asking open-ended questions, actively listening to the patient's responses, and using culturally sensitive communication techniques. The images and videos used in DSD should be carefully selected to ensure that they are culturally appropriate and resonate with the patient. This may involve using images of models from diverse ethnic backgrounds or avoiding images that may be considered offensive or inappropriate in certain cultures. Clear and effective communication is

essential for building trust and rapport with patients from different cultural backgrounds. Dentists should be sensitive to language barriers and cultural differences in communication styles. This may involve using interpreters, providing written materials in the patient's native language, or adapting their communication style to match the patient's preferences. DSD's collaborative approach allows patients to actively participate in the design process, ensuring that the final outcome aligns with their expectations and values. Dentists should encourage patients to express their opinions and concerns, and be willing to adjust the treatment plan based on their feedback.^{19,20}

5. Conclusion

The study's findings highlight the efficacy of DSD in achieving long-term stability and functionality of restorations, ensuring that esthetic enhancements are durable and sustainable. Moreover, the research emphasizes the importance of considering cultural nuances in esthetic dentistry, particularly in diverse contexts like Jakarta. By understanding and incorporating cultural preferences into the DSD process, dentists can tailor treatment plans to meet the unique needs and expectations of each patient, promoting inclusivity and patient-centered care. While DSD offers numerous advantages, it is essential to acknowledge the potential for complications and the importance of proactive management. Thorough treatment planning, meticulous execution, and regular monitoring are crucial for minimizing risks and ensuring the long-term success of DSD-guided restorations. Overall, this study underscores the transformative potential of DSD in revolutionizing esthetic dentistry, promoting patient satisfaction, and achieving predictable, long-term outcomes. By integrating advanced digital technologies with a patient-centric approach, DSD empowers both patients and dentists to embark on a transformative journey toward achieving optimal esthetic results.

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