The Role Of Patient-Reported Outcomes In The Management Of Traumatic Dental Injuries: A Comprehensive Review

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Abstract:

Traumatic dental injuries (TDIs) are a significant public health issue, affecting millions of individuals worldwide. The management of TDIs often focuses on clinical outcomes, but the incorporation of patient perspectives through the use of dental patient-reported outcomes (dPROs) is increasingly recognized as essential for providing patient-centered care. Dental patient-reported outcome measures (dPROMs) are the tools used to assess dPROs, offering valuable insights into the impact of TDIs and their treatment on patients' lives. This comprehensive review explores the current state of knowledge regarding the application of dPROs and dPROMs in the field of dental traumatology. The key dPROs identified include oral health-related quality of life, pain and discomfort,

aesthetics, function, adverse effects, patient satisfaction, number of clinical visits, and trauma-related dental anxiety. The review highlights the importance of integrating patient perspectives into clinical decision-making and research, as well as the potential benefits of using dPROs to guide treatment planning, evaluate treatment effectiveness, and improve patient outcomes. Future directions for research are discussed, emphasizing the need for standardized and validated dPROMs specific to dental traumatology, as well as the potential of electronic PROMs (ePROMs) for routine monitoring of patients after TDIs. By embracing a patient-centered approach that incorporates dPROs and dPROMs, dental professionals can enhance the quality of care for individuals affected by TDIs and contribute to the advancement of the field of dental traumatology.

Introduction:

Traumatic dental injuries (TDIs) are a significant global public health problem, affecting millions of individuals worldwide. Ranked as the fifth most prevalent disease or condition, TDIs can have far-reaching consequences on the oral health and overall well-being of affected individuals [8]. The management of TDIs often involves complex treatment decisions and long-term follow-up, making it essential to consider not only clinical outcomes but also patient-reported outcomes (PROs) to ensure patient-centered care.

In recent years, there has been a growing emphasis on incorporating PROs in healthcare decision-making and research. PROs are defined as any report of a patient's health condition that comes directly from the patient, without interpretation by a clinician or anyone else [1]. When applied to dentistry, these outcomes are referred to as dental patient-reported outcomes (dPROs). The use of dPROs allows for a more comprehensive understanding of the impact of oral health conditions and their treatment on patients' lives, beyond traditional clinical measures.

Dental patient-reported outcome measures (dPROMs) are the tools used to assess dPROs. These measures can be objective or subjective and are designed to capture patients' perspectives on various aspects of their oral health and treatment experiences. The use of dPROMs has gained traction in dental research, as they provide valuable insights into the

effectiveness of interventions from the patient's point of view [3].

In the field of dental traumatology, the incorporation of dPROs and dPROMs is particularly relevant, given the potential for TDIs to significantly impact patients' quality of life, oral function, and psychosocial well-being. However, the use of dPROs in this area has been limited, and there is a lack of standardization in the outcomes reported in TDI research [19].

This narrative review aims to provide an overview of the current state of knowledge regarding dPROs and dPROMs in the context of TDIs and their management. By synthesizing the available evidence, we seek to highlight the importance of incorporating patient perspectives in clinical decision-making and research related to dental trauma. Furthermore, we will discuss the potential implications of dPROs for improving patient care and advancing the field of dental traumatology.

Traumatic Dental Injuries:

Traumatic dental injuries (TDIs) encompass a wide range of injuries to the teeth, supporting structures, and surrounding soft tissues. These injuries can result from various causes, including falls, sports-related accidents, motor vehicle collisions, and interpersonal violence [12]. The global prevalence of TDIs is substantial, with estimates of 22.7% for the primary dentition and 15.2% for the permanent dentition [9]. The incidence of TDIs is highest among children and adolescents, making it a significant concern for pediatric dental care [10].

The clinical presentation of TDIs can vary greatly, from minor enamel fractures to more severe injuries such as luxation, avulsion, and root fractures. The type and extent of the injury, as well as factors such as the patient's age, stage of dental development, and time elapsed since the injury, can influence the prognosis and treatment options [19]. In addition to the immediate effects, TDIs can also have long-term consequences, including pulpal necrosis, root resorption, and tooth loss, which may require ongoing management [20-22].

The impact of TDIs extends beyond the physical damage to the dentition. These injuries can have significant psychosocial consequences, affecting patients' self-esteem, social interactions, and overall quality of life [17,18]. Moreover, the management of TDIs often involves multiple dental visits,

prolonged treatment, and associated costs, placing a considerable burden on patients and their families [9].

Given the high prevalence and multifaceted nature of TDIs, a comprehensive approach to their management is essential. This approach should encompass prevention strategies, timely diagnosis, appropriate treatment, and long-term follow-up [15]. Importantly, the incorporation of patient perspectives through the use of dPROs and dPROMs can help to ensure that the management of TDIs is patient-centered and addresses the aspects that matter most to those affected by these injuries.

Dental Patient-Reported Outcomes (dPROs) and Dental Patient-Reported Outcome Measures (dPROMs):

Dental patient-reported outcomes (dPROs) are defined as any report of a patient's oral health condition that comes directly from the patient, without interpretation by a clinician or anyone else [1]. These outcomes capture patients' subjective experiences, perceptions, and values related to their oral health and the impact of dental conditions and treatments on their lives. dPROs can encompass a wide range of domains, including oral health-related quality of life (OHRQoL), pain, functional status, and treatment satisfaction [2].

The assessment of dPROs is facilitated through the use of dental patient-reported outcome measures (dPROMs). dPROMs are standardized tools designed to collect information directly from patients about their oral health status and treatment experiences [2]. These measures can be objective, such as visual analog scales for pain intensity, or subjective, such as questionnaires assessing OHRQoL. The use of dPROMs allows for a systematic and reliable assessment of patients' perspectives, enabling comparisons across different populations and treatment modalities [3].

The incorporation of dPROs and dPROMs in dental research and practice has several important benefits. First, it allows for a more comprehensive evaluation of treatment outcomes, taking into account not only clinical parameters but also patients' subjective experiences [4]. This patient-centered approach can help to identify aspects of care that are most important to patients and guide treatment decisions that align with their values and preferences.

Second, the use of dPROs can enhance patient engagement and communication. By actively seeking patients' perspectives, clinicians can foster a collaborative relationship and involve

patients in their own care [5]. This can lead to improved patient satisfaction, adherence to treatment, and ultimately, better health outcomes.

Third, the incorporation of dPROs in dental research can help to advance the field by providing valuable insights into the effectiveness of interventions from the patient's point of view [3]. This information can guide the development of new treatment strategies, inform clinical practice guidelines, and support evidence-based decision-making.

In the context of dental traumatology, the use of dPROs and dPROMs is particularly relevant. TDIs can have a significant impact on patients' quality of life, oral function, and psychosocial well-being [18]. The assessment of these outcomes is essential to fully understand the burden of TDIs and to evaluate the effectiveness of management strategies in addressing patients' needs and concerns.

However, despite the potential benefits, the use of dPROs and dPROMs in dental traumatology research has been limited. A systematic review by Kenny et al. [19] found that only a small proportion of studies on TDIs included patient-reported outcomes, with most focusing on clinical parameters such as pulpal and periodontal healing. This highlights the need for greater incorporation of dPROs in future research to ensure a more comprehensive evaluation of treatment outcomes.

Importance of dPROs in Traumatic Dental Injuries:
The incorporation of dental patient-reported outcomes (dPROs) in the management of traumatic dental injuries (TDIs) is crucial for several reasons. First and foremost, dPROs provide a patient-centered perspective on the impact of TDIs and their treatment, which is essential for delivering care that aligns with patients' needs, preferences, and values [5]. By actively seeking patients' input, clinicians can gain a more comprehensive understanding of the physical, emotional, and social consequences of TDIs, enabling them to tailor treatment plans accordingly.

Second, the use of dPROs can help to guide clinical decision-making in the management of TDIs. The choice of treatment for a given injury often involves weighing various factors, including the type and extent of the injury, the patient's age and dental development, and the potential for long-term complications [19]. However, equally important are the patient's perspectives on the expected outcomes, such as aesthetics, function, and

quality of life. By incorporating dPROs into the decision-making process, clinicians can ensure that treatment choices reflect not only clinical considerations but also patients' priorities and expectations [32].

Third, the assessment of dPROs can provide valuable information for evaluating the effectiveness of different treatment approaches for TDIs. Traditional clinical outcomes, such as pulpal and periodontal healing, are undoubtedly important, but they may not fully capture the impact of treatment on patients' lives [33]. The inclusion of dPROs in research studies can help to identify treatments that not only promote clinical success but also optimize patients' oral health-related quality of life, function, and satisfaction [34].

Fourth, the use of dPROs can facilitate communication between clinicians and patients, as well as with other healthcare providers involved in the management of TDIs [35]. By using standardized dPROMs, clinicians can establish a common language for discussing the impact of TDIs and treatment outcomes, ensuring that all parties have a shared understanding of the patient's experiences and goals. This enhanced communication can lead to improved coordination of care, particularly in cases where multidisciplinary management is required.

Lastly, the incorporation of dPROs in dental traumatology research can help to advance the field by providing a more comprehensive picture of the burden of TDIs and the effectiveness of different management strategies [34]. The inclusion of patient perspectives can help to identify areas where current treatment approaches may be falling short and guide the development of new interventions that prioritize patients' needs and preferences. Moreover, the use of dPROs can enhance the relevance and applicability of research findings to clinical practice, ultimately leading to improved patient care.

In summary, the importance of dPROs in the management of TDIs cannot be overstated. By providing a patient-centered perspective, guiding clinical decision-making, evaluating treatment effectiveness, facilitating communication, and advancing research, the incorporation of dPROs has the potential to transform the way we approach dental trauma care. As the field of dental traumatology continues to evolve, it is essential that clinicians and researchers alike recognize the

value of dPROs and work to integrate them into both clinical practice and research endeavors.

dPROs Used in Traumatic Dental Injuries: Oral Health-Related Quality of Life (OHRQoL)

Oral Health-Related Quality of Life (OHRQoL) is one of the most important and widely studied dPROs in the context of traumatic dental injuries (TDIs). OHRQoL is a multidimensional construct that encompasses the impact of oral health conditions on an individual's physical, psychological, and social well-being [6]. The assessment of OHRQoL provides valuable insights into the broader consequences of TDIs, beyond clinical parameters alone.

Several studies have investigated the association between TDIs and OHRQoL in various populations. The impact of TDIs on OHRQoL appears to be influenced by factors such as the type and severity of the injury, the dentition affected, and the presence of other oral health problems [26-30]. For example, more severe injuries, such as avulsion and luxation, have been consistently associated with poorer OHRQoL outcomes compared to less severe injuries like enamel fractures [44,51,52].

The impact of TDIs on OHRQoL has been studied in both children and adolescents. In the primary dentition, studies have yielded mixed results, with some reporting no significant association between TDIs and OHRQoL [49,50], while others have found that severe injuries, particularly avulsion, negatively impact the quality of life of children and their families [52,53]. In the mixed and permanent dentitions, TDIs have been more consistently associated with poorer OHRQoL outcomes [54-59].

The management of TDIs, including factors such as the timing and type of treatment, can also influence OHRQoL. Untreated injuries, particularly in the permanent dentition, have been linked to reduced OHRQoL in various populations [47,60-62]. Prompt treatment of TDIs has been shown to improve OHRQoL outcomes, highlighting the importance of timely intervention [63,64]. However, there is limited research comparing the impact of different treatment modalities on OHRQoL, representing an area for future investigation.

The relationship between TDIs and OHRQoL is further complicated by the presence of other oral health conditions, such as dental caries and malocclusion. Several studies have

found that the co-occurrence of TDIs with these conditions can have a compounding negative effect on OHRQoL [41,44,66-70]. Therefore, it is important to consider the broader oral health status of individuals with TDIs when assessing and interpreting OHRQoL outcomes.

Socioeconomic factors have also been explored in relation to TDIs and OHRQoL, although the findings have been inconsistent. Some studies have reported that lower socioeconomic status, as indicated by factors such as family structure, income, and parental education, is associated with poorer OHRQoL outcomes in individuals with TDIs [39,40,46,52,57,67,72]. However, other studies have found no significant association between socioeconomic variables and OHRQoL in this context [44,55,66,73].

While the literature on TDIs and OHRQoL has provided valuable insights, there are limitations to consider. Many studies have relied on cross-sectional designs, which limit the ability to establish causal relationships. The assessment of TDIs has often been based on clinical examinations alone, potentially missing certain types of injuries that require radiographic detection. Furthermore, the grouping of TDIs of varying severities in some studies may obscure the impact of more severe injuries on OHRQoL.

Despite these limitations, the evidence suggests that TDIs can have a significant negative impact on OHRQoL, particularly in the mixed and permanent dentitions and when injuries are severe or untreated. The assessment of OHRQoL should be an integral part of the management of TDIs, as it provides a patient-centered perspective on the consequences of these injuries and the effectiveness of treatment. Future research should aim to address the limitations of existing studies and explore the impact of different treatment approaches on OHRQoL outcomes.

Symptoms (Pain and Discomfort)

Pain and discomfort are common symptoms reported by patients following traumatic dental injuries (TDIs) and their treatment. Pain is a complex, multifaceted experience that can be influenced by sensory, cognitive, emotional, and motivational factors [74]. In the context of TDIs, pain can be spontaneous or elicited by stimuli such as touching the affected tooth or surrounding tissues [5].

Discomfort is another frequently reported symptom after TDIs and their management. In dentistry, discomfort is often described as a subjective experience resulting from oral or facial symptoms (e.g., pain, swelling, bleeding, or infection), functional impairment (e.g., difficulty chewing, speaking, or maintaining oral hygiene), or general conditions (e.g., palpation, vomiting, or dizziness) [77-79].

The assessment of pain and discomfort is crucial in the management of TDIs, as these symptoms can significantly impact patients' quality of life and well-being. Various tools and methods have been used to measure pain in dental research, including numerical rating scales (NRS) and visual analog scales (VAS) [5,75,76]. However, the heterogeneity in pain assessment tools across studies can make comparisons challenging.

Pain and discomfort are common outcomes following various treatments for TDIs, such as root canal therapy, dental implants, intraoral bone grafting, and other interventions [4,75,76]. The experience of pain and discomfort can vary depending on factors such as the type and extent of the injury, the treatment modality, and individual patient characteristics.

Notably, pain and discomfort can have a significant impact on patients' oral health-related quality of life (OHRQoL). Pain is considered one of the four dimensions of OHRQoL, alongside functional limitations, psychological discomfort, and physical, psychological, and social disabilities [3,6]. Therefore, the assessment and management of pain and discomfort are essential aspects of patient-centered care in the context of TDIs.

In addition to their direct impact on patients' well-being, pain and discomfort can also influence treatment adherence and patient satisfaction. Patients who experience significant or prolonged discomfort may become anxious about their treatment, potentially leading to avoidance behaviors or non-compliance with post-operative instructions [79].

Aesthetics

Aesthetics is an important patient-reported outcome following traumatic dental injuries (TDIs), particularly when the injury involves the anterior teeth. The impact of TDIs on dental aesthetics can be significant, as even minor changes in the appearance of the teeth can affect an individual's self-esteem, social interactions, and overall quality of life [80,81].

Various types of TDIs can result in aesthetic concerns. For example, crown fractures, discoloration due to pulpal necrosis or calcification, and avulsion injuries can all lead to visible changes in the appearance of the affected teeth [81-83]. In addition, certain treatments for TDIs, such as root canal therapy or autotransplantation, may also impact dental aesthetics [82].

The assessment of aesthetics as a patient-reported outcome can be performed using various methods. Subjective evaluations by both the patient and the clinician are commonly used, often involving questionnaires or interviews [86,92]. Objective measures, such as the use of standardized color scales or spectrophotometric analysis, can provide more quantitative assessments of aesthetic outcomes [91].

Aesthetic concerns following TDIs can have a particularly significant impact on children and adolescents. The appearance of the teeth can affect a young person's self-confidence and social interactions, and dental aesthetics have been shown to be an important factor influencing oral health-related quality of life in this population [94].

The management of TDIs should prioritize the restoration of dental aesthetics, alongside the resolution of symptoms and the return of function. In the early stages of treatment, temporary measures may be used to address aesthetic concerns, while definitive aesthetic restoration is typically performed once the tooth has stabilized and the risk of further complications has been minimized [84].

Function

Traumatic dental injuries (TDIs) can have a significant impact on oral function, affecting an individual's ability to perform essential tasks such as biting, chewing, and speaking. The restoration of function is a key goal in the management of TDIs, as functional impairment can negatively impact oral health-related quality of life and overall well-being [80].

The type and extent of functional impairment following a TDI can vary depending on the nature of the injury. For example, avulsion injuries or the premature loss of teeth due to trauma can result in difficulties with biting and chewing, as well as changes in occlusion [80]. Injuries to the periodontal ligament, such as luxation or lateral displacement, can also affect the function of the affected teeth [81].

In addition to the direct effects of TDIs, certain treatments for these injuries can also impact oral function. For example, splinting or immobilization of injured teeth may temporarily restrict normal biting and chewing, while prosthetic replacements such as dental implants or autotransplantation may require a period of adaptation before optimal function is achieved [86,88].

The assessment of function as a patient-reported outcome can involve various methods, such as questionnaires, interviews, or performance-based measures. For example, the ability to bite and chew effectively can be evaluated using standardized tools or by assessing patient satisfaction with their masticatory function [86,92]. Speech function may be assessed through patient self-report or by objective measures such as speech sound production tests [87].

The impact of TDIs on oral function can be particularly significant in children, as injuries to the primary or mixed dentition may affect the development of the permanent teeth and the establishment of proper occlusion [80]. Early intervention and the restoration of function are essential in these cases to prevent long-term complications and ensure optimal oral health outcomes.

In summary, the assessment and management of oral function are critical aspects of patient-centered care following TDIs. Clinicians should prioritize the restoration of function alongside the resolution of symptoms and the achievement of aesthetic goals, taking into account the specific needs and preferences of each individual patient.

Adverse Effects

Traumatic dental injuries (TDIs) can lead to various adverse effects that may require further intervention and impact patient-reported outcomes. Common adverse effects following TDIs include pulpal necrosis, infection, root resorption, and tooth discoloration [4,20-22].

Pulpal necrosis is a frequent complication of TDIs, particularly in cases of severe luxation injuries or root fractures. Necrosis of the dental pulp can lead to pain, swelling, and the development of apical periodontitis, which may require endodontic treatment such as root canal therapy [4]. The presence of pulpal necrosis and its management can significantly impact patient-reported outcomes, including oral health-related quality of life and treatment satisfaction.

Tooth discoloration is another common adverse effect following TDIs and their treatment. Discoloration can occur due to the leakage of endodontic materials, the presence of necrotic pulp tissue, or the development of calcific metamorphosis [81,89,90]. The aesthetic impact of tooth discoloration can be a significant concern for patients, particularly when it affects the anterior teeth, and may necessitate additional interventions such as bleaching or restorative treatments [91].

Root resorption is a potential long-term complication of TDIs, particularly in cases of luxation injuries or avulsion [81]. External root resorption can lead to the progressive loss of dental hard tissues, compromising the structural integrity of the affected tooth and potentially leading to tooth loss. The management of root resorption may involve endodontic treatment, periodontal surgery, or even extraction in severe cases [20-22].

The assessment of adverse effects following TDIs is an important aspect of patient-centered care, as these complications can significantly impact treatment outcomes and patient well-being. Regular clinical and radiographic follow-up is essential to detect and monitor adverse effects, allowing for timely intervention when necessary.

Patient-reported outcome measures (PROMs) can be valuable tools for assessing the impact of adverse effects on patients' quality of life and treatment satisfaction. The use of standardized questionnaires or interviews can help clinicians to better understand patients' experiences and concerns, facilitating personalized management strategies that prioritize patient comfort and well-being [86,92].

In summary, the recognition and management of adverse effects are critical aspects of comprehensive care following TDIs. By incorporating patient-reported outcomes alongside clinical assessments, clinicians can develop targeted interventions that address the specific needs and preferences of each individual patient, ultimately improving treatment outcomes and patient satisfaction.

Patient Satisfaction

Patient satisfaction is a key patient-reported outcome in the management of traumatic dental injuries (TDIs). It reflects the degree to which a patient's expectations, preferences, and needs are met by the provided treatment and care experience

[86,92]. Assessment of patient satisfaction can provide valuable insights into the quality of care and help identify areas for improvement in the management of TDIs.

Various factors can influence patient satisfaction following TDIs and their treatment. These may include the effectiveness of the treatment in resolving symptoms and restoring function and aesthetics, the comfort and convenience of the treatment process, the quality of communication and patient-provider relationships, and the overall treatment outcome [76,86,92].

The assessment of patient satisfaction can be conducted using various methods, such as questionnaires, interviews, or rating scales. Standardized instruments, such as the Dental Visit Satisfaction Scale (DVSS), have been used to evaluate patient satisfaction in the dental setting [95]. Specific questions targeting aspects such as treatment outcomes, comfort, and aesthetics can provide a more comprehensive understanding of patient satisfaction in the context of TDIs [86].

In the pediatric population, assessing patient satisfaction may involve both the child and their caregivers. Children who have experienced TDIs may face unique challenges, such as increased dental anxiety or the impact of the injury on their self-esteem and social interactions [94,96]. Addressing these concerns and ensuring a positive treatment experience can contribute to higher levels of patient satisfaction and improved oral health-related quality of life.

Effective communication and patient-provider relationships are essential components of patient satisfaction. Clinicians should prioritize clear and empathetic communication, providing patients with adequate information about their condition, treatment options, and expected outcomes. Engaging patients in the decision-making process and considering their individual preferences and needs can foster a sense of trust and contribute to higher levels of satisfaction [5].

The assessment of patient satisfaction should be an ongoing process throughout the management of TDIs. Regular follow-up visits provide opportunities to monitor treatment progress, address any concerns or complications, and ensure that patients' expectations are being met. Incorporating patient feedback into treatment planning and decision-making can help to optimize outcomes and improve overall patient satisfaction.

In summary, patient satisfaction is a crucial patient-reported outcome in the management of TDIs. By prioritizing patient-centered care, effective communication, and the assessment of patient satisfaction, clinicians can develop personalized treatment strategies that address the unique needs and preferences of each individual patient. This approach can ultimately lead to improved treatment outcomes, enhanced oral health-related quality of life, and greater overall patient satisfaction.

Number of Clinical Visits

The number of clinical visits required for the management of traumatic dental injuries (TDIs) is an important patient-reported outcome that can impact treatment acceptance, adherence, and overall patient satisfaction [5,97]. TDIs often necessitate multiple visits for diagnosis, treatment, and follow-up care, which can place a significant burden on patients and their families in terms of time, cost, and convenience.

Several factors can influence the number of clinical visits required following a TDI. The type and severity of the injury, the presence of complications such as pulpal necrosis or root resorption, and the chosen treatment approach can all impact the frequency and duration of dental appointments [97]. For example, injuries involving complex fractures or extensive damage to the periodontal ligament may require more visits for treatment and monitoring compared to minor enamel-dentin fractures [98,99].

The assessment of the number of clinical visits as a patient-reported outcome can be conducted through various methods, such as reviewing patient records or conducting interviews with patients and their caregivers [98,99]. It is important to consider both the direct clinical time spent with the dental professional and the indirect time associated with travel, waiting, and post-treatment recovery [98,100].

Patient-related factors, such as the distance between the patient's residence and the dental clinic, the availability of transportation, and the patient's or caregiver's ability to take time off work or school, can also influence the perceived burden of multiple clinical visits [5,97]. Clinicians should be mindful of these factors and strive to develop treatment plans that minimize the number and duration of appointments whenever possible, without compromising the quality of care.

Effective communication and patient education are crucial in managing expectations regarding the number of clinical visits. Clinicians should provide clear information about the anticipated treatment timeline, the purpose of each visit, and the importance of adherence to the recommended follow-up schedule. Engaging patients and their caregivers in the decision-making process and considering their preferences and constraints can help to optimize treatment acceptance and compliance [5].

The use of teledentistry and remote monitoring technologies may offer opportunities to reduce the number of in-person clinical visits while still ensuring adequate follow-up care. Virtual consultations, remote symptom reporting, and the use of intraoral cameras or smartphone applications for patient-initiated imaging can help to identify complications early and guide treatment decisions, potentially minimizing the need for unnecessary appointments [5].

In summary, the number of clinical visits is an important patient-reported outcome in the management of TDIs, as it can significantly impact patient satisfaction, treatment adherence, and overall treatment success. Clinicians should strive to develop personalized treatment plans that balance the need for comprehensive care with the patient's individual circumstances and preferences. By optimizing the number and efficiency of clinical visits, clinicians can improve the patient experience and promote better oral health outcomes following TDIs.

Trauma-Related Dental Anxiety

Trauma-related dental anxiety is a significant patient-reported outcome in the context of traumatic dental injuries (TDIs). Dental anxiety refers to the fear or apprehension experienced by patients in relation to dental treatment, which can have a profound impact on their willingness to seek care, treatment adherence, and overall oral health outcomes [101,102].

TDIs can be particularly traumatic events, especially for children and adolescents, and may lead to the development or exacerbation of dental anxiety [23,103]. The experience of pain, the sudden nature of the injury, and the need for emergency dental treatment can all contribute to heightened levels of anxiety and stress in patients and their families.

The assessment of trauma-related dental anxiety is essential for providing patient-centered care and developing appropriate

management strategies. Various tools and scales have been developed to measure dental anxiety in different age groups, such as the Facial Image Scale for children aged 5-8 years, the Modified Child Dental Anxiety Scale (MCDAS) for children aged 8-12 years, and the Corah's Dental Anxiety Scale (DAS) for adolescents and adults [104-106].

Studies have shown that certain patient characteristics may be associated with higher levels of trauma-related dental anxiety. For example, girls, children with previous TDIs, and those who are generally more fearful of medical procedures have been found to experience greater anxiety following dental trauma [107,108]. Additionally, a child's age at the time of the injury and the presence of pain or visible damage to the teeth can also influence the likelihood of developing dental anxiety [103].

The management of trauma-related dental anxiety requires a multifaceted approach that addresses both the physical and psychological needs of the patient. Clinicians should prioritize creating a supportive and non-threatening environment, using age-appropriate communication techniques and behavioral management strategies to help patients feel more at ease [103]. The use of distraction techniques, such as music, movies, or virtual reality, may also be helpful in reducing anxiety during dental procedures [104].

Providing adequate pain control and minimizing discomfort during treatment is crucial for preventing the development or worsening of dental anxiety. The use of local anesthesia, nitrous oxide sedation, or other pharmacological interventions may be necessary to ensure patient comfort and cooperation [103]. Clinicians should also be attentive to the patient's emotional state and provide reassurance and positive reinforcement throughout the treatment process.

Effective communication with patients and their caregivers is essential for managing trauma-related dental anxiety. Clinicians should provide clear and age-appropriate explanations of the injury, the proposed treatment plan, and the expected outcomes. Encouraging patient involvement in the decision-making process and addressing any concerns or questions can help to foster a sense of trust and control, reducing anxiety levels [5].

In some cases, referral to a mental health professional or a specialist in dental anxiety management may be necessary to address more severe or persistent anxiety symptoms.

Collaborative care models that integrate dental and psychological services can be particularly effective in managing trauma-related dental anxiety and promoting better oral health outcomes [103].

In summary, trauma-related dental anxiety is a significant patient-reported outcome that can have a profound impact on the management of TDIs. Clinicians should be proactive in assessing and addressing dental anxiety, using age-appropriate tools and strategies to create a supportive and comfortable treatment environment. By prioritizing patient-centered care and effective communication, clinicians can help to minimize the psychological impact of TDIs and promote better oral health outcomes for patients.

Conclusion:

Traumatic dental injuries (TDIs) are a significant oral health problem that can have far-reaching consequences for patients' quality of life, functional well-being, and psychosocial health. The incorporation of dental patient-reported outcomes (dPROs) in the management of TDIs is essential for providing patient-centered care and optimizing treatment outcomes.

This narrative review has highlighted the key dPROs in the context of TDIs, including oral health-related quality of life (OHRQoL), pain and discomfort, aesthetics, function, adverse effects, patient satisfaction, number of clinical visits, and trauma-related dental anxiety. The assessment of these outcomes using appropriate dental patient-reported outcome measures (dPROMs) can provide valuable insights into patients' experiences, preferences, and needs, guiding treatment decisions and informing clinical practice.

The impact of TDIs on OHRQoL has been widely studied, with evidence suggesting that more severe injuries and untreated trauma can have a significant negative effect on patients' quality of life. Pain and discomfort are common symptoms following TDIs and their treatment, and effective management of these outcomes is crucial for promoting patient comfort and treatment adherence. Aesthetics and function are also important considerations, as TDIs can lead to visible changes in the appearance of the teeth and impairments in biting, chewing, and speaking.

Adverse effects, such as pulpal necrosis, root resorption, and tooth discoloration, can further complicate the management of TDIs and impact patient-reported outcomes. Regular clinical

and radiographic follow-up, along with the use of dPROMs, can help to identify and address these complications in a timely manner. Patient satisfaction is a key indicator of the quality of care provided and should be assessed throughout the treatment process, considering factors such as treatment effectiveness, comfort, and communication.

The number of clinical visits required for the management of TDIs can significantly impact patient satisfaction and treatment adherence. Clinicians should strive to develop personalized treatment plans that minimize the burden of multiple appointments while ensuring comprehensive care. Trauma-related dental anxiety is another important dPRO that can influence patients' willingness to seek care and cooperate with treatment. Effective assessment and management of dental anxiety, using age-appropriate strategies and communication techniques, are essential for promoting better oral health outcomes.

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