Dental patient-reported outcomes following traumatic dental injuries and treatment: a narrative review

Abstract

Dental patient-reported outcomes (dPROs) are self-reported descriptions of a patient's oral health status that are not modified or interpreted by a healthcare professional. Dental patient-reported outcome measures (dPROMs) are objective or subjective measurements used to assess dPROs. In oral healthcare settings, the emphasis on assessing treatment outcomes from the patient's perspective has increased and this is particularly important after traumatic dental injuries (TDIs), as this group of injuries represent the fifth most prevalent disease or condition worldwide. The purpose of this review is to summarise the current use of dPROs and dPROMs in the field of dental traumatology. Oral Health-Related Quality of Life, pain, swelling, aesthetics, function, adverse effects, patient satisfaction, number of clinical visits, and trauma-related dental anxiety are the key dPROs following TDIs. Clinicians and researchers should consider the well-being of patients as their top priority and conduct routine evaluations of dPROs using measures that are appropriate, accurate and reflect what is important to the patient. After a TDI, dPROs can assist clinicians and patients to choose the best management option(s) for each individual patient, and potentially improve the methodology, design and relevance of clinical studies.

Keywords

Dental patient-reported outcomes, Dental patient-reported outcome measures, dental traumatology, pain, Oral Health-Related Quality of Life.

1. AIM OF THE REVIEW

Dental practitioners who care for patients who have suffered traumatic dental injuries (TDIs) should routinely assess the sequelae of treatment using not only clinician-reported outcomes but also patient-reported outcomes (PROs) using reliable and valid measures. In order to not only promote a better understanding of the patient's experience but also encourage further research into dPROs, the objective of this review is to provide an overview of dental patient-reported outcomes (dPROs) and dental patient-reported outcome measures (dPROMs) in the field of dental traumatology. The regular use of dPROs and dPROMs by clinicians and the data they generate will over time add value to the experience of patients following TDIs and potentially have a positive impact on their subsequent management.

2. DENTAL PATIENT-REPORTED OUTCOMES (dPROs) and DENTAL PATIENT-REPORTED OUTCOME MEASURES (dPROMs)

In dentistry, the term "dental patient-reported outcome" (dPRO) refers to any report of a patient's oral health state that comes directly from the patient themselves, without interpretation by a clinician or another person.[1] Patient reported outcome measures (PROMs) "seek to ascertain patients' views of their symptoms, their functional status, and their health-related quality of life (HRQoL)"[2] and it is preceded with a "d" for dental, dPROMs, when focused within the field of dentistry. In oral health research, dPROs are gaining popularity not only because they capture what is important to the patient in order to determine the most effective treatment from the patient's perspective,[3] but also form an essential feature of clinical guideline development.[4] Within dentistry, pain is often measured by various tools and methods (e.g. numerical rating scales) that

makes comparison between and across different studies difficult.[5] On the contrary, the Oral Health Impact Profile (OHIP) is a global instrument with established validity, reliability and precision that not only assesses pain, but also functional limitations, handicaps, and psychological discomfort, as well as physical, psychological and social disabilities in relation to an oral disorder, thus enabling measurement of an individual's Oral Health-Related Quality of Life (OHRQoL).[6] Notably, OHRQoL is the most significant dPRO and a major contributor to HRQoL.[7]

3. TRAUMATIC DENTAL INJURIES

TDIs have been ranked as the fifth most prevalent disease or condition in the world after dental caries, tension-type headaches, iron-deficiency anaemia and hearing loss.[8] The global prevalence of TDIs has been reported to be 22.7% for the deciduous dentition and 15.2% for the permanent dentition, with over one billion people having experienced TDIs.[9] The incidence of TDIs is variable across different age groups, being highest amongst children under 12 years of age.[10] TDIs can be caused by multiple events such as road traffic accidents, collisions during recreation and/or sporting activities, fights etc., that can have broader physical and psychosocial implications than just the TDI *per se*.

A range of sociodemographic, clinical and environmental factors are associated with a greater chance of TDI occurrence.[11] The role of gender and age as risks factors are well known, whereas others such as ethnicity and socio-economic status (SES) require further understanding.[12] Clinical dental factors include increased overjet, non-nutritive sucking behaviours, a soft tissue lip trap, Class II skeletal relationship[13–15] and inadequate lip coverage of the anterior teeth.[16] Thus, TDIs are the second highest dental

public health problem that impact children, affecting their masticatory function and quality of life, as well as creating ongoing economic consequences.[9,17,18] Disease prevention is favoured over disease management, with interceptive orthodontic treatment and use of mouthguards advocated for reducing the incidence of TDIs within children and adolescents.[15] If TDIs do occur, retention of the damaged deciduous or permanent teeth, where possible, and repair, regeneration or both of the surrounding tissue is encouraged in order to preserve function and aesthetics.[19] TDIs can have long-term sequelae (e.g. pulp necrosis, apical periodontitis or invasive cervical resorption) requiring further clinical intervention to promote favourable outcomes, including those relevant to the present review such as root canal treatment, surgical intervention and decoronation.[20–22]

4. dPROs IN TRAUMATIC DENTAL INJURIES

It is evident that the currently reported outcomes of TDIs are numerous, varied, and heterogeneous, which results in difficulties when comparing studies and significant bias when evaluating reports in this area. In addition, it is not clear how and when these outcomes should be recorded.[19] While dPROs are under-represented in published studies on TDIs,[19] this, along with cross-study heterogeneity also impedes the conduct of meaningful meta-analyses.[23] Assessing treatment outcomes after TDIs has traditionally focused on clinical outcomes that rely on clinical and radiographic examination and special tests. Conversely, PROs such as quality of life (QoL) and trauma-related dental anxiety have been undervalued and not traditionally employed. A systematic review reported that PROs were poorly represented in the published research on TDIs.[19] Consequently, there is likely to be a lack of evidence connecting the management of TDIs to PROs.

In recent years, the use of PROs in clinical trials has increased, with 6168 (45.1%) of the 13,666 trials documented in the Australian-New Zealand Clinical Trials Registry including at least one PRO.[24] Within endodontology, up to 2010, 19% of studies on root canal treatment and retreatment, and apexification procedures used dPROs, which has subsequently increased to 30%.[25] In a similar manner, researchers have more recently focused on PROs assessing the impact of TDIs and their management on OHRQoL compared with clinician reported outcomes in the field of dental trauma. For example, between 2017 and 2022, six systematic reviews were published assessing the impact of TDIs and their management on OHRQoL.[18,26–30]

5. IMPORTANCE OF dPROS IN TRAUMATIC DENTAL INJURIES

Patient involvement in outcomes research "may improve the relevance of research questions",[31] with consideration of dPROs in conjunction with clinical outcomes being essential to ensuring "greater understanding of patient priorities, preferences, values, expectations, and experiences".[5] Otherwise, if a clinician's viewpoint is used to interpret a patient's perspective of treatment, valuable information from the patient's point of view on the effectiveness of treatment risks being ignored, leading to patient dissatisfaction due to unfulfilled expectations and a perception of being ignored.[5]

The advantages of using dPROs following treatment of TDIs includes:[32–35]

- Providing a more comprehensive view of treatment benefits and costs to aid clinicians and patients to select the most suitable treatment. For example, an uncomplicated crown fracture may be restored in various ways including re-

attachment of the fractured segment if the patient has kept it, a direct resin-based composite restoration, an indirect restoration (with various materials). Each has its own clinical and aesthetic advantages and disadvantages, and respective time requirements. There are also vast cost differences which must be discussed with the patient.

- Providing information to enhance clinical decision-making for the management of TDIs. For example, an avulsed tooth with an extended extra-oral dry time in a young patient will over time predictably develop ankylosis and external replacement resorption.[36] Management options include no treatment, decoronation, extraction or auto-transplantation. Each carries important consequences including aesthetics, loss of alveolar bone and soft tissue, the need for an interim prosthesis, and the long-term replacement of the tooth. In the case of long term extra-alveolar time, replantation is the recommended option as it will keep future treatment options open while restoring aesthetics and function in the interim, as well as maintaining alveolar bone in the edentulous space that may be required for future restorative options.[37]
- PROs can contribute to the improvement of future clinical trial methodologies and be utilised as effective research outcomes for the development and evaluation of new drugs and therapies because they enable the estimation of treatment advantages and disadvantages separately from standard clinical measures of effectiveness.
- Improved translation of research studies to patients and lay stakeholders, for example understanding the management of TDIs in their own words.

6. dPROs USED IN TRAUMATIC DENTAL INJURIES

OHRQoL

The effect of TDIs on OHRQoL is complex and should take into consideration several clinical and non-clinical variables. OHRQoL is a global outcome measure encompassing functional limitations, oral symptoms, emotional and social impacts.[5] TDIs may affect the OHRQoL of participants and also that of their families and/or carers.[38–42]

TDIs have a range of clinical presentations from an enamel fracture to tooth avulsion, with some studies reporting an association between the severity of the injury and its impact on the OHRQoL,[43,44] but not others.[45] Injuries can involve variable numbers of teeth during different dentition and root maturation stages. These injuries can be managed with alternative protocols or can even remain untreated. The impact of TDIs on ORHQoL may be affected by other oral conditions such as dental caries and malocclusion.[46,47] Injuries to multiple teeth are considered more common in traumatic events such as accidental falls and trips, acts of violence, sports, and road traffic accidents.[12]

TDIs can occur in conjunction with other oral and maxillofacial hard and soft tissue injuries as well as broader bodily injuries that can also affect the QoL of the patient. Bodily injuries may cause other non-dental disabilities and their management including long-term hospitalisation, which negatively influences the QoL of the subjects,[48] and requires interdisciplinary management. Several studies from Brazil have assessed TDIs in the primary dentition.[49,50] When all types of TDIs were pooled, injuries in the primary dentition did not affect the OHRQoL, a finding that is likely to be due to a high incidence of enamel fractures in young children,[44,49–52] which have limited impact

on OHRQoL.[51] Conversely, severe TDIs were associated with poorer outcomes in a study that focussed on the primary dentition.[53] Amongst the different clinical presentations, tooth avulsion was associated with a negative impact on OHRQoL for the children and their families, although interestingly tooth discolouration had a negative effect solely on the parents.[52] The latter is in agreement with a study where TDIs were associated with poorer outcomes for children, although only more severe presentations (i.e., avulsion and luxation) were reported by parents to have negative effects.[44] Mild dental trauma to the primary dentition appears to have a limited effect on OHRQoL.

The assessment of the association between TDIs and OHRQoL in the mixed and permanent dentitions has also attracted attention.[54–59] When assessing the type of injury, crown fractures were associated with poorer OHRQoL amongst young children and adolescents in Brazil,[56,59] and India.[58] Two Brazilian studies that studied trauma involving periodontal ligament damage (i.e. luxations and avulsion) reported negative outcomes in 12-year-olds[55] and 8-10 years old children.[57] Finally, tooth avulsion amongst children under-18 had an adverse effect on OHRQoL in an Italian population.[54] Thus, TDIs in the mixed and permanent dentitions appear to have a negative effect on OHRQoL.

The management of TDIs (e.g., treatment versus non-treatment and likely treatment modalities) may also impact OHRQoL. The absence of treatment may negatively impact OHRQoL due to potential functional and/or aesthetic limitations and depends on the severity of the injury. Untreated injuries in the permanent dentition commonly have a negative impact, as observed amongst 12-14 years old adolescents in Canada,[60] 12 years old Jordanians,[47] 12-14 years old Brazilians,[61] and Albanians aged

16-19 years.[62] Severe untreated injuries are also associated with a negative impact on the OHRQoL scores of Brazilian adolescents.[63] For the management of tooth avulsion, replantation, if possible, is the best treatment option.[54,59] Conversely, a study in Brazil showed that the absence of treatment for crown fractures extending beyond enamel had no negative effect on OHRQoL.[59] In addition, a separate study from Brazil where children aged 8-14 years were treated for crown fractures reported enhanced OHRQoL scores for children, but no effect for their families.[64] Furthermore, even following treatment, adolescents are at risk of having poorer QoL when compared with their uninjured peers.[65] No studies are available comparing different treatment modalities and their effect on OHRQoL.

The role of dental caries and malocclusion as confounding factors when assessing the impact of TDI on OHRQoL may vary depending on clinical and participant-related factors. Studies from Brazil, Colombia, and Peru have reported a significant impact in OHRQoL amongst children aged 1 to 14 years for experience of dental caries and TDI when compared with occlusal discrepancies.[41,44,66–69] Nonetheless, the additional impact of dentofacial anomalies plus TDIs on OHRQoL was highlighted in a study from India.[70] A study into 8-10 years old from Belo Horizonte, Brazil reported that dental caries had a higher impact on OHRQoL than TDIs and malocclusion.[71] Similarly, another Brazilian study of 5-6-year-old children showed that severe caries, but not TDIs, was associated with poorer perception for children and carers with regards to OHRQoL.[49] These findings are in agreement with a comparable study also from Brazil.[72] Therefore, TDIs should be considered alongside, not independent to, other oral presentations and diseases, when evaluating OHRQoL.

The role of SES on the association between TDIs and OHRQoL has been assessed with conflicting results, making definitive conclusions difficult. Amongst the studies reporting the negative impact of SES on OHRQoL, some criteria have been highlighted, such as: non-nuclear families (single parents or living with others),[41] lower income,[40,46,52,67,72] and low-level parental schooling/education.[39,57] Conversely, other studies have reported no significant association between OHRQoL and SES.[44,55,66,73]

The limitations of studies assessing the effect of TDIs on OHRQoL should be emphasised. Population studies rarely include radiographic examination, thus some types of injuries, such as root fractures, may elude detection during dental examinations in the absence of subsequent special tests. Grouping of TDIs of variable severity may mask negative effects on OHRQoL of more severe injuries, as less severe presentations may have a limited impact on this outcome measure and possibly be more detectable with clinical examination. Study designs in this area are often retrospective and/or cross-sectional in design and this can have a negative effect on the level of evidence on the topic and the ability to rigorously compare injuries. Experimental trials on the topic are not possible for ethical reasons, as participants cannot be intentionally subjected to TDIs. However, the role of various clinical and non-clinical factors, plus the management of the injury and the subsequent impact on OHRQoL is amenable to further assessment and does require further high-quality clinical studies.

Symptoms

Symptoms following treatment for TDIs are usually assessed on an individual basis as pain/swelling or indirectly as discomfort. Pain in endodontics has been defined as a "multifactorial noxious experience that involves a sensory response that can be

modified by cognitive, emotional and motivational influences related to past experience".[74] Pain can be spontaneous or it can be elicited by touching the tooth and/or the related soft tissues, with the latter often defined as 'tenderness'.[5] In dentistry, pain is an important dPRO as well as having an influence on the Oral Health Impact Profile (OHIP) tool[6] and on one of the four dimensions of the OHRQoL (orofacial pain).[3] Pain and/or tenderness occur following most of the treatments provided after a TDI such as root canal treatment,[4] dental implants,[75] intraoral bone grafting,[76] amongst others. The outcome assessment tools for postoperative pain following endodontic treatment generally involve a 11-point rating scale ranging from "no pain" to "worst possible pain"[76] or a numerical rating scale (NRS) ranging from 0 to 10.[75]

The dental literature defines discomfort as a subjective experience resulting from oral or facial symptoms (pain, swelling, bleeding, and infection),[77] functional impairment (chewing, speech, and oral hygiene maintenance),[78] or general conditions (palpation, vomiting, and dizziness)[79] after dental treatment. Patients may become anxious about their treatment if they experience severe or ongoing discomfort.

Aesthetics

Aesthetics is an important characteristic of all dentitions. For example, it has been reported that fracture, displacement, and/or early loss of one or more primary maxillary incisor teeth will inevitably lead to impaired aesthetics in pre-school children.[80] When comparing intrusion injuries to other sub-types of luxation injuries, intrusion injuries result in higher mineralisation abnormalities in successionary teeth. Mineralisation disturbances are typically linked to an aesthetic concern, which is crucial for the permanent incisors.[81] Likewise, discolouration of the crown was commonly

encountered in the crowns of teeth following regenerative endodontic procedures.[82] A systematic review reported that the most common unfavourable effects of trauma to permanent teeth are enamel hypoplasia and white or yellow brown discolouration.[81] After trauma, pulp hyperaemia and pulpal haemorrhage release haemoglobin and erythrocyte products, resulting in crown discolouration. Due to the development of an apical tissue coagulum and subsequent odontoblastic stimulation, subluxated and intruded teeth exhibit a phenomenon known as amorphous calcification, which can also affect the subsequent colour of the crown.[83] The initial or emergency phase of treatment for TDIs includes care to relieve symptoms and to restore aesthetics and function.[84] Aesthetic impairment can be indirectly evaluated in pre-school children through questionnaires by assessing the parental demand for replantation of avulsed teeth.[85] Czochrowska et al.[86] evaluated the aesthetic outcome of autotransplanted premolars replacing maxillary incisors in adult patients by obtaining their opinions through the use of a questionnaire. The questions targeted the colour, length, width and position of the transplanted tooth and the patients' responses were categorised as satisfied, acceptable, and dissatisfied. Overall, 73% of the patients were satisfied with the aesthetic outcome of transplanted premolars.

Function

Speech is a function that may be affected as a consequence of sudden and premature loss of deciduous teeth following a TDI.[80] Gable et al.[87] conducted a non-randomised trial with 26 children following the natural exfoliation of their primary maxillary incisors and a further 26 children who had the same teeth extracted prematurely. Following the eruption of their permanent incisors, all subjects underwent testing for speech impairment. Intriguingly, there was no significant difference between the groups

for speech articulation impairments. Age-related reductions in articulation errors were seen in both groups, indicating a maturation effect. In addition to TDIs, post-trauma treatment could also have an impact on speech such as following autotransplantation[86] and implant placement.[88]

Adverse effects

Adverse effects following TDIs often include pulpitis or pulp necrosis with infection and apical periodontitis which require some form of endodontic intervention.[4] Discolouration due to the leaching of medicaments, root canal cements or endodontic materials into the dentine surrounding the pulp chamber is a known adverse effect following root canal treatment. Discolouration may also occur because of pulp canal calcification or pulp necrosis, as a response to trauma, following autotransplantation,[89] replantation[90] and luxation injuries.[81] Pulp canal calcification, pulp necrosis and tooth loss are the most prevalent outcomes of luxation injuries.[81] Discolouration can be measured subjectively by both the dentist and the patient or objectively using a spectrophotometer.[91]

Patient satisfaction

Patient satisfaction may include feedback specifically about the treatment delivered, which adds value during assessment of a patients' perception of a successful or unsuccessful treatment, usually measured through a patient questionnaire.[86,92] In cases of auto-transplantation, aesthetic outcomes have been measured as a part of the patient's satisfaction by recording their responses in a 4-point Likert scale within a questionnaire.[86] Satisfaction can also be recorded qualitatively in the form of interview

with the patient that includes self-assessment as well as verbal evaluation of the procedure *per se* and long-term morbidity (discomfort, loss of sensation, and pain).[76] In this context, an 11-point rating scale has been used for self-assessment and a dichotomous scale for verbal evaluation. Patient satisfaction for implant-supported single crowns rated on a 4-point scale has been reported to be 93-98%.[93] In the context of satisfaction for paediatric patients, they should receive prompt, high-quality dental care that addresses symptoms and signs, as well as restores both tooth function and aesthetics. The prevalence of young people using social media, which potentially fuels bullying and taunting connected to appearance, is a growing concern.[94] Hakeberg et al. [95] assessed childrens' satisfaction towards the dentist using the Dental Visit Satisfaction Scale – Swedish version (DVSS-SV). In a study conducted to assess the psychosocial impact of TDIs on the self-esteem of adolescents using Rosenberg's self-esteem scale, children with TDIs reported poor self-esteem, which may lead to loss of an individual's self-confidence.[96]

Number of clinical visits

The number of treatment and review visits is a secondary outcome associated with the nature and course of treatment offered for TDIs of both deciduous and permanent teeth.[97] The number of visits is usually measured by either verifying the patient's dental records or through retrospective multiple interviews of patients and their companions (relatives, neighbours, teachers and others) by telephone.[98,99] The main factors that can influence the number of dental visits are clinically-related: complicated hard tissue injuries, complicated or uncomplicated periodontal injuries, the diagnosis and treatment of pulp necrosis, and treatment approaches of the clinician. Patient-related factors that can also determine the number of appointments include proximity of the

patient's residence to the clinic,[5,97] availability of appointments,[5] as well as patient preferences for the number of visits as there may be a desire to limit absence from work, particularly when this is related to loss of earnings.[5] Thus, consideration of both clinical and patient-related factors is essential when deciding on the number of visits required in order to ensure that patients may experience high levels of satisfaction.[5] Furthermore, the time involved for dental visits can be categorised as direct (involving professional healthcare providers) and indirect time (involving companions, e.g. relatives, neighbours, teachers and others).[98,100]

Trauma related dental anxiety

TDIs involving children are likely to increase their levels of dental anxiety.[23,101] Dental fear is a common emotional response to a particular external threat in a dental scenario. When a child experiences dental anxiety, they sense a generalised feeling of apprehension that is linked to aberrant circumstances.[102] Dental fear is also characterised as a special type of anxiety that is accompanied with a propensity for having a negative dental experience.[103] Dental anxiety in children can be effectively measured by the clinician using various age-dependent tools such as: 5-8 years – Facial imaging scale;[104] 8-12 years – Faces version of the Modified Dental Anxiety Scale ($MCDAS_f$);[105] 12 years and above – Kleinknecht's Dental Fear Survey (DFS) and/or Corah's Dental Anxiety Scale (DAS).[106] Skaare et al.[107] distributed a questionnaire to care givers to assess the possible distress related to trauma of primary teeth during the follow-up examination of the permanent successors. Generally, girls, children who were more fearful of medical procedures,[108] and children with previous TDI were highly anxious.[108] Additionally, males and children who had experienced oral trauma had a generally more aggressive nature. There is a strong link between children's aggressive

behavior and dental anxiety and the likelihood of displaying violent behaviour increased marginally with the increase in anxiety level.[108]

7. CORE OUTCOME SET (COS) IN TRAUMATIC DENTAL INJURIES

In an attempt to address heterogeneity and encourage the use of dPROs, the International Association of Dental Traumatology established a group of international experts to develop core outcome sets (COS) for TDIs in children and adults.[23] A COS is a collection of agreed-upon standard outcomes that must be included, measured, and reported at a minimum level in all clinical trials and outcome studies undertaken in a particular field. The protocol for developing the COS in dental traumatology followed an established methodological framework with prospective registration in the Core Outcome Measures in Effectiveness Trials (COMET). The process involved the identification of outcomes using literature searches and a web-based questionnaire that involved dentists globally, followed by an online Delphi process that determined the most significant outcomes for inclusion. Following the online Delphi process, conference calls were held to finalize the COS for severe TDIs. Finally, 23 outcomes were considered, 13 of which were "generic" and 10 of which were "injury-specific".[23] These COS can be used in future clinical and research studies, reviews, and the development of future clinical practice guidelines for TDIs with the hope that this will improve future research and allow meta-analyses to be performed.

8. FUTURE DIRECTIONS FOR RESEARCH

- Population level studies, ideally collecting outcomes consistent with COS from multiple centres, will be an ideal source of data when assessing dPROs in relation to TDIs.

- Future randomised clinical trials (when possible for management modalities) and observational studies should consider incorporating dPROs in addition to collecting data on clinical outcomes. Patients, patient representatives, or both, should be involved in deciding the appropriate patient-defined outcomes that are important to them.[109] This will eventually result in patient-centred, evidence-based care, enhancing the value of treatment following TDIs.
- Most PROMs used in dental traumatology are generic. Consequently, it is necessary to develop a set of validated dPROMs that are specific to the field of dental traumatology and then to map these to the four-dimensional framework (Oral function, Orofacial appearance, Orofacial pain, and Psychosocial impact). These steps will standardize the evaluation of various TDI treatment outcomes, which will facilitate synthesis of multiple research reports through systematic reviews and meta-analyses.
- Future research should identify the dPROMs applicable to TDIs, which will ultimately result in the identification of the most suitable outcome measures for patients undergoing treatment of TDIs moving forward.
- Clinicians and researchers have the opportunity to adopt electronic PROMs (ePROMs) for the routine monitoring of patients after a TDI and its management. ePROMs offer patients an "electronic" means of data submission, through any internet-connected device (e.g., PC, smartphone or tablet), providing clinicians and researchers with a flexible platform for viewing PROM data.[110,111] Patients suffering from cancer and chronic kidney disease, for instance, have reported that the ePROM platform is a beneficial tool that improves their outcomes.[112,113]

9. CONCLUSION

The important dPROs following TDIs are OHRQoL, pain, swelling, aesthetics, function, adverse effects, patient satisfaction, and trauma-related dental anxiety. The continued development of dPROs and an understanding of what matters to patients, clinicians and academics can improve therapies and research, which will ultimately benefit the management of DTIs, patient well-being, and wider society. To accurately represent the effects of TDIs and their treatment on patients, the proper use of dPROs is essential in dental traumatology. To more accurately capture the viewpoints of patients undergoing treatment following TDIs, a novel and unique assessment tool should be developed.

CONFLICT OF INTEREST

The authors declare there are no competing interests for the current manuscript. No funding was received for the current work.

ETHICAL STATEMENT

No ethics approval was required for this manuscript.

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