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Global status of knowledge of parents for emergency management of traumatic dental injuries: a systematic review and meta-analysis

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KEY POINTS

- Gives the first ever evidence analysis of the global status of awareness related to prevention and emergency management of traumatic dental injuries.
- The methodology can be useful of public health researchers performing systematic reviews of questionnaire-based studies.
- Can be useful for developing educational tools and modules for parents.
- Can be useful for policy makers regarding effective policy for prevention and emergency management of traumatic dental injuries.

RESEARCH PROTOCOL: The protocol was developed as per the recommendations of the Cochrane-handbook and PRISMA and was registered in PROSPERO.
LITERATURE SEARCH: Search was performed by using MeSH-Terms and keywords in PubMed, Scopus, Embase, Web of Sciences, Lilacs, and Cochrane databases and gray literature sources 15th July 2022. There were no limits regarding the year of publication and language. Hand-searching of included articles was also performed. Titles and abstracts and later full texts were screened as per strict inclusion and exclusion criteria.
DATA EXTRACTION: Self-designed pilot-tested form was used.
QUALITY APPRAISAL: Risk of bias was analyzed through Joanna-Brigg's-Institute's-critical appraisal checklist. The evidence analysis was done by using the GRADE approach.
DATA ANALYSIS: Qualitative synthesis was performed for describing the study characteristics, details of sampling, and results of various questionnaires. It was discussed by the expert group and presented using KAP heat map. Meta-analysis was done by using Random Effects Model.
RESULTS AND INTERPRETATION: The risk of bias was found to be low in seven and moderate in one study. It was observed that >50% of parents knew about the urgency to seek professional advice after TDI. Only <50% of parents were confident of their ability to identify the injured tooth, clean the soiled avulsed tooth, and perform the replantation. Appropriate responses regarding immediate action after tooth avulsion were given by 54.5% (95% CI: 50.2–58.8, $p = 0.042$) of parents. The knowledge of the parents regarding the emergency management of TDI was found to be inadequate. The majority of them were interested in obtaining information about dental trauma first aid.

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BACKGROUND

Traumatic dental injuries (TDI) have been regarded as one of the most prevalent noncommunicable diseases[1]. They have a higher predilection for two age groups which have also been termed peaks of incidence. The first peak occurs at 2–3/4 years of age and is common for both males and females. The second peak, more common in males, occurs at 9–10 years of age[2]. Petti et al. used the global population and the burden of diseases data of 2016 to extrapolate that about 180 million children must have suffered from an injury to primary teeth and about one billion in permanent dentition[1]. The prevalence of TDI in primary teeth has been reported as 22.7% (95 CI: 17.3–28.7%) and that of permanent teeth was reported as 15.2% (95 CI: 13.0–17.4%)[1]. This highlights that most of the individuals get injured before the age of 18 years when they are living with their parents or dependent upon them[3]. Several authors have also highlighted that home is one of the commonest sites where children get injured[2,3].

International Association of Dental Traumatology (IADT) guidelines emphasized that the immediate management of most TDI is essential for long-term good survival of the traumatized tooth/teeth[4–7]. This becomes more prudent in the severe form of TDI such as tooth avulsion, and intrusive, extrusive, lateral luxations[4–7]. Andreasen et al. established that the survival of the tooth and its vital structures such as periodontal ligament (PDL) and pulp is

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dependent upon effective emergency management[8–10]. Since trauma can occur at any place, this treatment often has to be rendered by the people present in the vicinity of the injured child[11]. The stakeholders involved in such trauma scenarios are generally school teachers, sports coaches, and parents[11]. The better understanding of dental trauma first aid can play an important role in empowering these stakeholders for confident handling of TDI to children[12]. Education of the parents is even more important because they are the primary care providers and decision makers for the child's well-being and must be able to take proactive steps for safeguarding their children from the adverse consequences of untreated/ improperly treated injuries[13]. The fracture of teeth, their discoloration and improper position, etc can psychologically affect the child. This can be easily prevented through onsite dental trauma first aid[4–7].

Tewari et al. established that the knowledge of school teachers regarding the prevention and emergency management of TDI was inadequate, globally[11]. There are several studies that have evaluated the awareness levels of parents, especially mothers[13–20] but the overall global scenario is yet to be deciphered. Hence, this systematic review (SR) aimed to evaluate the global status of the knowledge of the parents regarding the emergency management of TDI, and to provide the recommendations for future research.

METHODS

Protocol and registration

The SR was performed according to the Cochrane handbook and reported as per the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)[21–23]. An *a priori* protocol was prepared after an expert group discussion, and registered in PROSPERO (CRD42021293430).

Eligibility criteria for study selection

Inclusion criteria.

- Studies related to the PICO of the research question (Table 1).
- All descriptive, observational, Cohort studies, Cross-Sectional, Case-control studies, and Randomized/ Non-Randomized trials.

Exclusion criteria.

- The case reports, case series, letter to the editor, comprehensive and systematic reviews.
- Studies with inadequate information regarding the questionnaire, the methods used for development and validation.

Information sources

The search was conducted independently by two reviewers (NT and SG) in PUBMED, Scopus, LILACS, Cochrane, Embase and Web of Science by on 15th July 2022 (Table 1). The gray literature was searched through Google Scholar and open Gray by the same reviewers. The reference search of the included articles was done manually for exploring all the available records related to the research question.

Search

The search strategy was defined as per the Population (P), Intervention (I), Comparator (C), and Outcome (O) elements of the research question and included MeSH terms, keywords, and use of Boolean operators 'AND' and 'OR' in different combinations. This was done without any limitation of language and time.

Screening and selection of studies

The searches were saved electronically in the EndNote reference management software (EndNote-TMX9 Clarivate Analysis, USA) and duplicates were removed by using the same. The details of search strategy and inclusion/exclusion criteria have been summarized in Table 1 and the search strategy results for different search engines in the online Supplementary Information. Scrutiny of the titles and abstract was independently performed by NT and SG with a high level of agreement as reflected by Cohen's Kappa value of 0.92. Full texts of the selected articles were downloaded and subjected to scrutiny by NT and SG. This step showed high level of agreement (Cohen's Kappa value of 0.95). In any event of disagreement in any of these steps, the senior reviewer (VM) was consulted for consensus.

Data extraction

Expert group discussion was held to formulate a data extraction sheet and it was pre-tested in a sample of 5 studies. Two reviewers SG and SS performed the data extraction independently to record the information related to study demographics, study design (type, duration, sampling strategies), details of the questionnaire (source, language, questions, validity, and reliability of questionnaire and mode of administration), details of the results and conclusion. A strategy to contact the authors for obtaining more details had also been formulated but it was not required in the present review.

Study quality assessment

The risk of bias in the included studies was assessed by two reviewers (SG and SS) by using Joanna Brigg's Institute (JBI) critical appraisal checklist for analytical cross-sectional studies. The agreement of reviewers for data extraction and ROB analysis was also found to be good with Cohen's Kappa values ranging from 0.85–0.97. Any disagreement was resolved by consulting the senior reviewer (VM).

Qualitative synthesis

The details of questions from the studies were used to develop a "KAP-HEAT Map", on the basis of the number of studies which included a question[11,12,24–26]. This visual map included the

Table 1. Details of the Population (P), Intervention (I), Comparator (C), Outcome (O) elements of the research question, the search strategy, and inclusion & exclusion criteria.

PICO elements of the Research Question
P- Parents of any gender or race I- Knowledge, Attitude, Awareness and Practice questionnaire evaluating one or multiple aspects of prevention and/or emergency management of traumatic dental injuries C- Not required/ Not mandatory O- Level of one or more aspects of knowledge, attitude, awareness and practice regarding prevention and/or emergency management of traumatic dental injuries
Search Strategy
Field 1: Traumatic Dental Injuries OR Dental Trauma OR Tooth avulsion OR Tooth Fracture OR Tooth Trauma OR Tooth Injuries OR Tooth Luxation or Dental injuries OR Crown Fracture OR Crown Root fracture OR Root Fracture OR Dento alveolar fracture OR Subluxation OR Concussion OR Contusion OR Lateral Luxation OR Intrusion OR Intrusive Luxation OR Extrusion OR Extrusive Luxation OR Fractured Tooth Field 2: Knowledge OR Attitude OR Practice OR KAP OR Awareness Field 3: Parents OR Parent OR Father OR Mother

Details of the search strategies for each of the databases has been included in the online Supplementary Information.

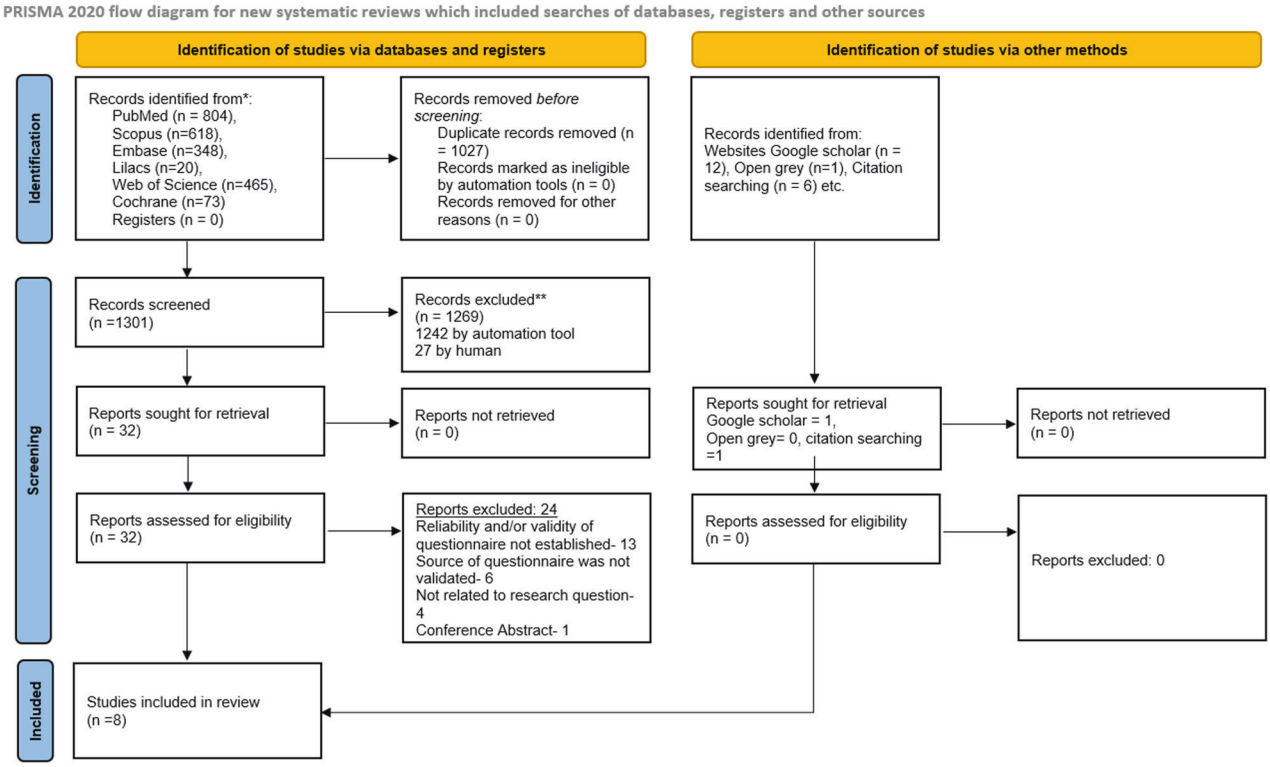

Fig. 1 PRISMA chart. The details of the searches, scrutiny and selection, along with the reasons for the exclusion.

questions which were common to 3 or more studies (1/3 of the included studies). The map was coded into five different colors which represented the level of awareness among parents related to a question (dark blue-not included, white-< 25%, light yellow-25–50%, dark yellow- 51–75%, and red- >75%[11,12,24–26].

Meta-analysis and evidence grading

KAP heat map also helped in deriving data for meta-analysis. The level of awareness of the questions common to five or more studies and with homogeneity in the outcome assessment and interpretation were analyzed by using the random effects model. The analysis was performed by Comprehensive Meta-analysis Software (New Jersey, USA) by NT. Same software was used for assessing the publication bias by using Funnel plot and Egger's test. The strength of evidence regarding the outcomes of meta-analyses was assessed on the basis of the recommendations of GRADE for non-randomized studies.

RESULTS

Search results

The search revealed a total of 2328 records from databases and 19 through other sources. After the removal of duplicates, titles abstracts of 1301 of them were screened, which resulted in 32 articles for full text assessment. Final scrutiny resulted in the inclusion of eight articles in the SR[13–20]. The details of search results, excluded studies and the reasons for exclusion are given in Fig. 1 and the online Supplementary Information.

Quality assessment

Risk of bias was found to be low in all the studies except Ahmed et al. which had moderate risk[20]. The paucities regarding the strategies to deal with confounding factors were identified in four studies[13,15,17,20] and a lack of clarity regarding inclusion criteria was seen in one study (Table 2)[20].

Study characteristics

The studies had been published between 2014 to 2020 with three from 2020[18–20]. Among them, three had been performed in Saudi Arabia[17,18,20], two in India[13,15], and one each in Kuwait[16], United Arab Emirates[19] and Brazil[14]. All the studies except Murali et al.[13] and Costa et al.[14] were cross-sectional in design[15–20]. All the studies reported a lack of awareness and inadequate knowledge among parents regarding the management of dental trauma and/or dental avulsion (Table 3)[13–20].

Questionnaire characteristics

The mode of distribution of the questionnaire in the majority of studies was self-administration[16–18,20], followed by personal interviews in two studies[13,14]. The mode of distribution was not mentioned in the two studies[15,19]. The questionnaire was available in two or more languages in three studies[13,15,19], one language in two studies[16,18]. English language was the main language in three studies and used in combination with Tamil[13], Hindi, and Bengali[15] and Arabic[19], Arabic had also been used in two other studies[16,18]. The sources of Questionnaires had been mentioned in only three studies[15,16,18]. The questionnaires had used objective questions[13–18,20] while this detail was not available in one study (online Supplementary Information)[19]. The knowledge of parents was assessed by all the studies except one which evaluated the perception of parents[14]. Along with this, the attitude was evaluated in three studies[13,15,18] and practice in one study[13]. The number of questions varied from 5 to 33[13–20], the validity was not reported in three studies[15,17,19] and reliability was not reported in one study (online Supplementary Information)[13].

Sampling characteristics

The sampling strategy had not been mentioned in four studies[13–15,20] while others had simple random ($n = 2$)[16,19], stratified cluster random ($n = 1$)[17], and convenience sampling ($n = 1$)[18]. The sample size had been statistically justified in four studies[16,18–20] and it ranged from 150[13] to 3367[17] parents. The parents had been recruited from the out-patient departments (OPD) ($n = 2$)[13,15], health care centers (PHC) ($n = 2$)[14,17], dental specialty centers ($n = 3$)[17–19] and directly from the community in one study[20]. Five studies had included both the parents[15,16,18–20] whereas the other three had been done in mothers[13,14,17]. There was variability in the age groups of parents, however, the majority of them ranged between 20–40 years. Costa et al[14] included 15–18 years old pregnant women as one of the groups while three of them had an age category of 51–60 years too[13,19,20]. The marital

Table 2. Risk of bias in the included studies as per Joanna Briggs Institute's Critical Appraisal Checklist.

Author and year	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects and the setting described in detail?	Was the exposure measured in a valid and reliable way?	Were objective, standard criteria used for measurement of the condition?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was appropriate statistical analysis used?	Risk of Bias
Murali et al. 2014[13]	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Low
Costa et al. 2016[14]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Kaul et al. 2016[15]	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Low
Alyahya et al. 2018[16]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Al-Sehaibany et al. 2018[17]	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Low
Alharbi et al. 2020[18]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Hussain et al. 2020[19]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Ahmed et al. 2020[20]	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Moderate

status, details of off-springs and employment status had been mentioned in the study done by Al-Sehaibany et al.[17] and Alharbi et al.[18]. Most of the parents were married with two children in both the studies[17,18]. Large number of parents were working ($n = 244$) in the study done by Al-Sehaibany et al.[17] while Alharbi et al.[18] had reported that most of the parents were unemployed ($n = 2503$). The majority of the parents were graduates or had a professional degree in four of the included studies[16–19] while the education level was less than graduation in the other four studies[13–16]. The details of socio-economic status were given in two studies and it was reported as middle income status (online Supplementary Information)[17,18].

Details of the questions

The questions included in three or more studies were used for making the "KAP-Heat Map" (Fig. 2). It was observed that 25–50% of the parents had witnessed any form of TDI in three[15,18,20] and 50–75% in two of the six studies which included this question[14,17]. While only 4.7% of parents had witnessed it in one study[13]. When the parents had been enquired whether they had obtained any information about TDI in past, three of the four studies which included this question reported that 25–50% of the parents had responded in affirmation[15,17,19] while it was <25% in the study done by Alyahya et al.[16]. The source was reported as a dentist in Alyahya et al.[16] and Al-Sehaibany et al.[17], while the information was obtained by "friends" in Alharbi et al. (online Supplementary Information)[18]. The appropriateness of immediate action after avulsion of tooth was correctly responded by 50–75% of the parents in four of the five studies[15,17–19] and 25–50% in Murali et al.[13]. Three of the included studies had enquired about parent's ability to identify the injured tooth with two studies reporting the correct response rates as 25–50%[15,17] and 50–75 % in one study each[20]. Correct method of cleaning the soiled avulsed tooth was enquired in four studies and was known to 25–50% of the parents in three[15,16,18] and 50–75% in one study[13]. When the parents were asked if they can perform the replantation of the avulsed tooth in their child, <25% of them responded in affirmation in two[15,19] and 25–50% in the other two studies which included this question[16,20]. Awareness regarding the immediate or early replantation of avulsed tooth was known to 25–50% of the parents in all the three studies which had enquired about it[16–18]. Similarly, <25% of them were aware of the appropriate storage medium for the avulsed tooth in five[15–17,19,20] and 25–50% in two of the seven studies which had enquired about it[18,20]. The question about the urgency to seek professional advice after TDI was included in five studies with 50–75% of the parents replying correctly in three studies[13,16,18] more than 75% in one study[15] and 25–50% in one study[20]. Dentists were reported as the first choice of the professionals to be contacted after TDI by >75% of the parents in three of the four studies which enquired about it[15,16,18]. It was 25–50% in the study done by Ahmed et al.[20]. More than 75% of the parents in all three studies which enquired about it, reported that they wanted to obtain more information about the management of TDI (Fig. 2)[15,17,20]. The questions included only in one or two studies have been detailed separately in the online Supplementary Information. The majority of parents responded negatively when asked "What did you do for the trauma?"[20], "Can you identify the type of tooth injury?"[14], "Have you (mother) ever had any dental trauma?"[13] in one study each.

Meta-analysis

Meta-analysis could be performed for three of the questions regarding witnessing of TDI in past, immediate action after tooth avulsion, and best storage media for storage of avulsed tooth. The pooled percentage of affirmative responses of the parents regarding witnessing TDI was 32.9% (95% CI: 22.7–44.9, random effects model, $p = 0.006$) (Fig. 3). The immediate action after tooth avulsion was known to 54.5% (95% CI: 50.2–58.8, random effects model, $p = 0.042$) of the parents (Fig. 4). The appropriate response rate regarding the storage medium for the avulsed permanent tooth was 21.3% (95% CI: 16.8–26.5, Random effects model,

Table 3. Details of the country, design, duration and conclusion of the included studies.

Author	Year	Journal	Country	Type of Study	Conclusion
Murali et al.[13]	2014	Journal of Indian Society of Pedodontics and Preventive Dentistry	India	NM	Lack of awareness among the mothers regarding the emergency management of dental trauma.
Costa et al.[14]	2016	International Dental Journal	Brazil	Cohort	Lack of awareness among mothers
Kaul et al.[15]	2016	Journal of Clinical and Diagnostic Research	India	Cross-sectional	Knowledge level was not satisfactory
Alyahya et al.[16]	2018	Medical Principles and Practice	Kuwait	Cross-sectional	Inadequate knowledge of emergency management for dental avulsion
Al-Sehaibany et al.[17]	2018	Clinical, Cosmetic and Investigational Dentistry	Saudi Arabia	Cross-sectional	Insufficient knowledge
Alharbi et al.[18]	2020	The Open Dentistry Journal	Saudi Arabia	Cross-sectional	Inadequate levels of knowledge to manage deciduous and permanent tooth avulsion
Hussain et al.[19]	2020	Brazilian Journal of Oral Sciences	UAE	Cross-sectional	Lack of knowledge regarding permanent tooth avulsion among parents
Ahmed et al.[20]	2020	European Endodontic Journal	Saudi Arabia	Cross-sectional	Parents were unaware of emergency management for tooth avulsion

Author	Year	Have you witnessed any TDIs in the past?	Have you obtained information about TDIs previously?	Immediate action after tooth avulsion	Correct identification of tooth	Clean the dirty tooth	Attempt for self-replantation	Time for replantation	Storage medium for storing	Urgency to seek professional advice	First professional to contact	Would you like to receive information about TDIs?
Murali et al	2014	4.7		45.3		58.2			0	75		
Costa et al	2016	57.9										
Kaul et al	2016	30.1	28.2	51.7	36.4	40.7	21.4		20.65	84.4	79.1	84.7
Alyahya et al	2018		17.8			32.9	27.8	29.2	15.2	70.6	94.8	
Al-Sehaibany et al	2018	54	36.1	53.1	33			46	18			83.9
Alharbi et al	2020	28.5		58		25.4		26.5	27.7	57.5	94.4	
Hussain et al	2020		39.2				16.5		21.9			
Ahmed et al	2020	35		61.7	60		49		31.3	37	40	93.8
Number of studies		6	4	5	3	4	4	3	7	5	4	3
Color codes			Not Included		<25%		26-50%		51-75%		>75%	

Fig. 2 KAP-Heat Map. The question stems included in 3 or more studies (Blue: question not included, red: > 75%, dark yellow: 50–75%, lemon yellow: 25–50%, light yellow: < 25% sports persons and coaches giving correct responses. Width of columns was proportional to the number of studies which included the question stems.

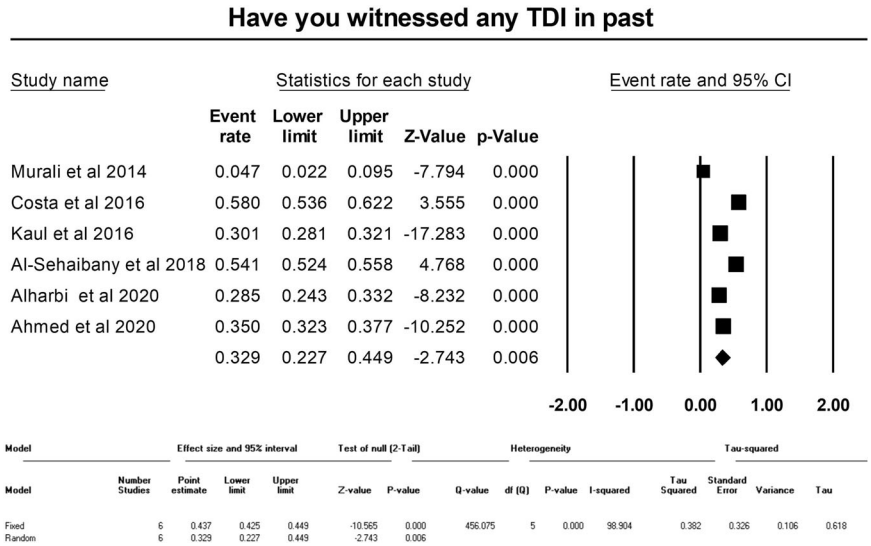

Fig. 3 Forest plot. The pooled correct response percentage for question regarding best storage media for storage of avulsed tooth.

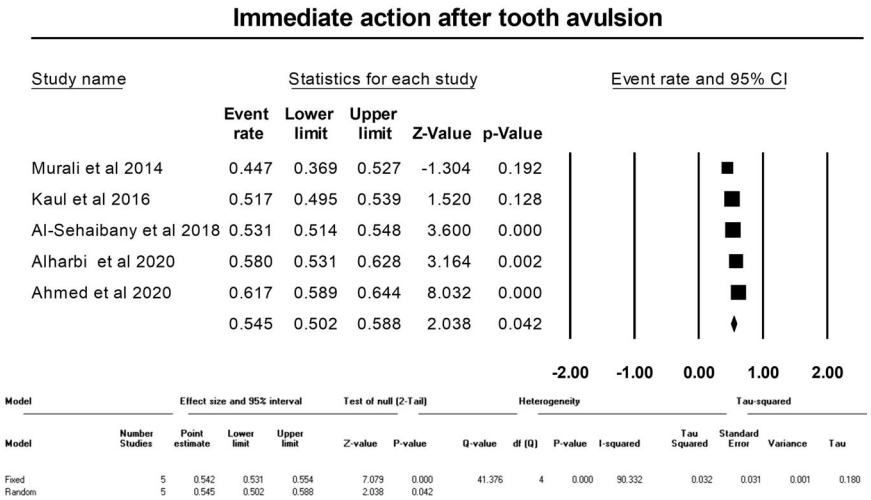

Fig. 4 Forest plot. The pooled correct response percentage for question regarding immediate action after tooth avulsion.

$p < 0.001$) (Fig. 5). All the meta-analyses displayed significant heterogeneity (I^2 values ranging from 90.33 to 98.90) and publication bias (depicted in the Funnel plots and Egger's test) (Figs. 3–5, online Supplementary Information).

Grading of evidence

The strength of evidence regarding the outcomes of all the meta-analyses was graded to be very low (Table 4). This was done on the basis of the non-randomized nature of the included studies,

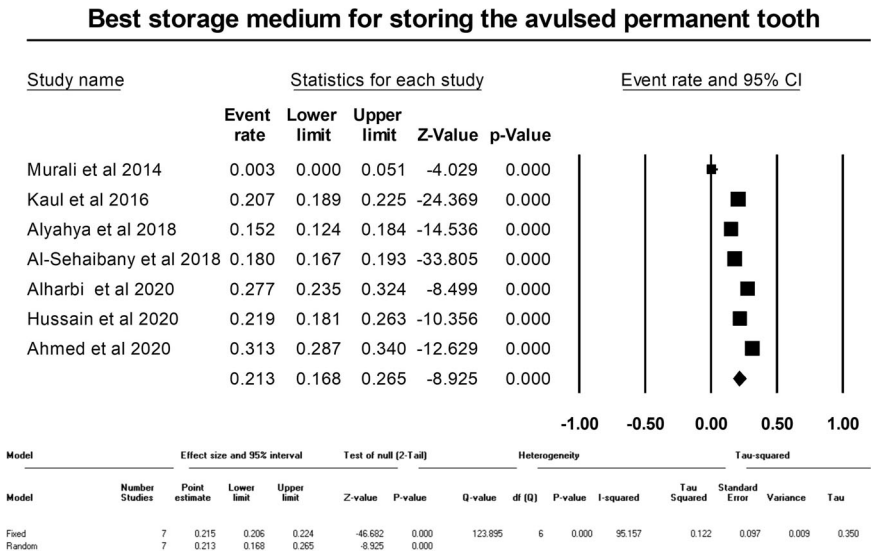

Fig. 5 Forest plot. showing the pooled correct response percentage for question regarding best storage media for storage of avulsed tooth.

Table 4. Details of the strength of evidence for the outcomes of the three meta-analyses as per recommendations of GRADE.

Outcome	Evidence base	Reasons for upgrading or downgrading	Strength of evidence (GRADE)
Have you witnessed any TDI in past	Study design- 6 studies (Non RCTs): LOW $n = 7613$	Downgrading factors: 1. Presence of Heterogeneity ($I^2 = 98.90$) 2. Presence of imprecision due to 4 studies[13–15, 17]. 3. Presence of publication bias. -Presence of plausible confounding factors.	⊕OOO Very Low
Immediate action after tooth avulsion	Study design- 5 studies (Non RCTs): LOW $n = 7111$	Downgrading factors: 1. Presence of Heterogeneity ($I^2 = 90.33$) 2. Presence of imprecision due to 3 studies[13, 15, 17]. 3. Presence of publication bias. -Presence of plausible confounding factors.	⊕OOO Very Low
Best storage medium for storing the avulsed permanent teeth	Study design- 7 articles (Non RCTs): LOW	Downgrading factors: 1. Presence of Heterogeneity (I 2 = 95.15) 2. Presence of imprecision due to 3 studies[13, 15, 17]. 3. Presence of publication bias. -Presence of plausible confounding factors.	⊕OOO Very Low

the presence of heterogeneity, the presence of imprecision, the presence of publication bias and the presence of plausible confounding factors.

DISCUSSION

Children and adolescents are highly vulnerable to injuries[2,3]. The changes in lifestyles have seen the advent of newer causative modalities of TDI[27]. As a result, it is important to educate the parents towards the basics of prevention and emergency management of TDI[20]. This serves dual purposes, firstly they will be able to attend to the emergency situation faced by their child more effectively and without panic, and secondly, they will be capable of understanding the importance of comprehensive dental treatment and follow-up for reducing the risks of adverse consequences of TDI[13–20]. IADT has clearly laid down the instructions that can be given to the parents when contacted during tooth avulsion[6]. The pandemic of COVID 19 also saw an increased involvement of parents in the health care of their children, even partnering in managing emergencies[28]. Evidence mapping in dental traumatology had highlighted that there is a paucity of evidence analysis in its preventive domain[29]. Previous works addressing this aspect tried to elucidate the global status of knowledge regarding prevention and emergency management of TDI among its stakeholders such as school teachers, sports persons and coaches, dental professionals, and non-dental health care professionals[11,12,24,25]. Hence it was envisaged that similar status for the parents will help in understanding their level of awareness and developing strategies for educating them.

The previous SRs assessing the knowledge levels had highlighted few of the problems associated with the synthesis of the qualitative research studies[11,12]. Hence the expert group for this SR took that into consideration and developed a protocol based upon the recommendations of evidence mapping, Cochrane handbook, and PRISMA guidelines[21,22,29]. The thoroughness of the literature search was ensured to address the research questions and no limitations of language or year of publication were considered. Inclusion and exclusion criteria ensured that only the studies involving parents (mother and/or father) were included and not the caregivers as that can add to the variations in the selected groups. Further, all the steps of the SR were performed by two experienced reviewers and the inter-examiner agreements

were assessed. The strategy for solving the disagreement by consulting with a senior reviewer was also employed. Similarly, the extracted data was discussed by the expert group for better interpretation. These manoeuvres were considered important for increasing the reliability of the present SRs observations.

The strict inclusion criteria resulted in the exclusion of 97.54% of the articles during the screening of titles and abstracts and later 75% of those which were assessed during full-text evaluation. This might have also resulted in the exclusion of studies with high risk of bias. All the studies had been published in the last 8 years[13–20] and all except one had originated from Asia[14]. This can be attributed to the criteria of including the studies which had used validated and/or reliable questionnaires, which was not an essential methodological characteristic in most of the studies done in past. The language of the questionnaire is related to the region of the study and the same was reflected in the present review, with English being the primary language in the majority of them[13,15,19]. It was observed that the sampling strategy was either not mentioned or not appropriate in most of the studies[13–15,20], and the sample size had not been calculated in half of the studies[13–15,17]. These are important aspects of public health research and must be addressed in the future. The inclusion of > 50 years old parents was observed in several studies[13,15–17,19,20]. It was observed as a paucity and would have been better if the parents whose children were less than 14 years of age were included. Further, future researchers must also try to provide greater details of the study subjects such as education levels, occupation, and socio-economic status, which were deficient in several of the included studies.

KAP-Heat Map has been a useful adjunct in summarizing the details of the questionnaires in the previous SRs related to the assessment of knowledge[11,12,24–26]. The present review used the heat map of the questions included in three or more studies for creating the visual map of the knowledge status of parents and deriving the data for meta-analysis. Four of the studies exclusively evaluated the knowledge regarding emergency management of the avulsed permanent tooth[15,16,18,20] and others too had several questions related to this injury[13,14,17,19]. More than half of the parents in the majority of the studies knew about the immediate actions to be performed after avulsion of tooth[14,17,18,20], urgency to seek professional advice after TDI[13,15,16,18]. This reflected that the parents considered TDI as an emergency and their response was positive for the better care of their children. However, except for one study[15], none of them reported having more than 75% of the parents with appropriate responses. It was good to see that more than 75% of the parents in one[15] and more than 90% in two studies regarded dentists as the first choice of professionals to be contacted after TDI[16,18]. On the contrary, less than half of the parents in the majority of studies were confident of their ability to identify the injured tooth[15,18], to clean the soiled avulsed tooth[15,16,18] and to perform the replantation of the avulsed tooth in their child[15,16,19,20]. Similarly, 25–50% of the parents were aware of immediate or early replantation of avulsed tooth[16–18] and <25% of them were aware of the appropriate storage medium for the avulsed tooth[15–17,19]. It was observed that though less than half of the parents in majority of studies had received any information about TDI in past[15–17,19], more than 75% of them were interested in getting more information about management of TDI[15,17,20]. These trends and the pooled response percentages revealed by the meta-analysis highlight that the parents in the included studies did not have adequate knowledge regarding the key aspects of the emergency management of TDI. Though it was reported that they were keen on getting the information[13–20]. This matter must be given due importance by the dental and public health associations along with the associations of pediatric dentistry and dental traumatology, for developing validated modules and materials for educating parents globally. Mobile applications such as Tooth SOS and Injured tooth, and websites of traumatology associations such as IADT have tried to provide information to the public and content of similar nature can be used for increasing the awareness of the parents[30]. It was observed that none of the studies had enquired about the knowledge regarding the prevention of TDI. This must be part of the education modules for parents for making the play areas safe, reducing the sources of injury, and details about the use of mouth guards for their children. The major limitation of this SR is the heterogeneity observed among the primary studies and their nonadherence to the best practices of qualitative research and reporting, which also resulted in the very low strength of the evidence of the outcomes of the three meta-analyses. These must be addressed in future primary studies. SRs such as this one often suffers from problems in literature search and the existence of bias in selection. However, vigilant steps based on the best practices of evidence-based medicine were taken to reduce them.

CONCLUSION

The knowledge of the parents regarding the emergency management of TDI was found to be inadequate. Less than half of parents were confident of their ability to identify the injured tooth, to clean the soiled avulsed tooth, and perform the replantation of the avulsed tooth in their child. Similarly, less than half were aware of immediate or early replantation of the avulsed tooth and less than a quarter knew about the appropriate storage medium for the avulsed tooth. The majority of them were interested in obtaining information about dental trauma first aid. The included studies were mostly from Asia and had a high level of variability in their methodological and outcome assessment characteristics.

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AUTHOR CONTRIBUTIONS

The idea was conceptualized by NT. The team comprising of all the co authors designed the protocol and the methods of the systematic review. The review of literature was conducted by NT, SG and supervised by VPM. The data extraction was performed by SG, SS and supervised by VPM. The quality analysis was performed by SS, SG. Interpretation was performed by all the authors and co authors. The initial draft of the manuscript was prepared by NT, KB and SG. It was revised by all the authors.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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