ORIGINAL RESEARCH



Influence of children's dental trauma education from community dentists on the cognitive level of children and parents

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Abstract

Background: Dental trauma affects the physical and mental health of children, many countries are looking for ways to reduce its occurrence. Community doctors in China are responsible for the treatment and education of children, and their educational role in the impact of dental trauma on children has been rarely reported. Methods: 512 pairs of students and parents of first- and second-graders from 3 primary schools were selected. Children's cognitive level regarding dental trauma was investigated using a self-designed questionnaire. Student and parent sections were included in the questionnaire. All study subjects were lectured on prevention and treatment strategies for dental trauma. Questionnaires were completed before and one month after the lecture. Data from valid questionnaires were analyzed by SPSS 24.0. Quantitative data were presented as mean \pm standard deviation ($\bar{x} \pm S$). McNemar test were performed on the general data of children and parents regarding their knowledge of dental trauma. We analyzed the influencing factors of dental trauma using the χ^2 test. The *p*-value was set at 0.05. Results: This study revealed permanent tooth trauma often occurs in children aged 7-9 years old in their maxillary anterior teeth. Dental trauma knowledge among students and their parents, both improved after the lecture. Conclusions: Community dentistled education effectively enhances both children's and parents' understanding of dental trauma, which is crucial to effective prevention and management.

Keywords

Dental trauma; Oral health education; Community doctors; Cognitive level; Children

1. Introduction

Dental trauma in children, which is defined as acute damage to the dental body, pulp, and periodontal tissue caused by external forces, is one of the most common diseases in children [1]. Boys are more likely than girls to suffer permanent tooth trauma to the maxillary anterior teeth during their 7to-9-year-old years. Dental trauma incidence ranges from approximately 6.33% to 41.3%. Different designs, diagnostic criteria, restricted age ranges, different behavioral cultures and geographical locations may account for this large gap [2– 5]. Due to China's rapid social development, advances in science and technology, the constant emergence of new sports, transportation, toys, and children's participation in these social activities, dental trauma incidence has increased in recent years.

Dental trauma can be caused by falling, slapping, hard objects, and traffic accidents [6, 7]. Tooth trauma affects not only children's appearance and function, but also their psychology, behavior, and personality, and even their families [8]. Children and adolescents suffer from dental trauma at an alarming rate because of its high incidence, extensive etiology,

and significant loss [9].

In children and adolescents, dental trauma is common and a correct diagnosis and treatment are essential for a favourable long-term prognosis [10]. Avulsion of permanent teeth is one of the most serious dental injuries [11]. Correct placement of permanent teeth within 30 min after an accident significantly increases the likelihood of the tooth surviving. Correct implantation within 2 h after the accident significantly reduces complications. For exposed cases of young permanent anterior teeth, timely treatment and correct diagnosis and treatment of injured children contribute to the success of conservative treatment schemes and good long-term efficacy [12]. However, many parents or teachers have no experience of the emergency treatment of dental trauma when dental trauma occurs in children, leading to irreversible damage to teeth and great physical and mental harm.

Globally, childhood dental trauma is a significant problem, as is the low frequency of medical visits in children. Thus, different methods have been developed to reduce dental trauma in children in many countries. Public awareness of dental trauma is deepened through comic books in some countries [13]. Some countries call for more training of dentists and nurses in dental trauma. Recently, with the application of these procedures in Western countries, oral diseases have decreased. However, dental trauma is still a major contributor to dental morbidity and mortality (tooth loss) [14]. Therefore some scholars encourage to use mouthguard for reducing dental trauma [15]. Furthermore, developed countries have included emergency dental trauma treatment courses in their primary school curriculums. Teachers need relevant professional training [16], and schools should be equipped with emergency response strategies, such as biological boxes for the preservation of dislocated teeth and an emergency referral system. In Brazil, community health workers, professionals who have access to a wide variety of people, play a significant role in prevention and health promotion strategies. Through their missions, patient knowledge and attitudes toward dental trauma have changed [17]. Prevention has reduced the incidence of dental trauma in foreign countries. However, the majority of domestic studies have favored treatment in this regard.

Education courses on children's dental trauma are rare in Chinese educational institutions. There has been some work on dental trauma, but some school clinics only have saline, and many children, parents, and teachers are unaware of how to prevent and treat dental trauma in children [18]. Injured children's best treatment is delayed, follow-up treatment becomes more challenging and costly, and the cure is hampered [19]. Since 2011, Guangzhou has been promoting pit and ditch closure projects among second-grade students. Every year, community dentists visit schools to publicize the knowledge of pit and ditch closure. However, they seldom educate children about dental trauma. The fourth National Oral Health Epidemiology Survey questionnaire included relevant content on children's dental trauma. However, the cognition of parents of children's dental trauma is not involved. Furthermore, there is limited research on the impact of paediatric dentists or community dentists' dental trauma education on children and parents [20].

Therefore, this study aimed to investigate the occurrence of dental trauma and influencing factors among first- and secondgraders in Guangzhou primary schools, to determine the cognitive level of children and parents, explore the feasibility of the knowledge lectures given by community dentists to publicize the knowledge of dental trauma, evaluate the correlation between the effectiveness of community doctors and the cognitive level of children and parents of dental trauma, determine the incidence of dental trauma in children in Guangzhou, help develop a database of childhood oral health status, and to provide an objective basis for the prevention and treatment of dental trauma in primary medical care in the region.

2. Materials and methods

2.1 Sample size estimation

Based on the two major objectives of this study, a sample size estimate was made. To understand the cognitive status of children and parents of dental trauma before the lecture, the sample size of the single sample mean survey was calculated according to the following formula:

$$N = \frac{\left(Z_{\alpha/2} + Z_{\beta}\right)^2 \sigma^2}{\epsilon^2}$$

Where α is set at 0.05, β is set at 0.10, the study efficacy is 0.90, σ , according to the survey calculation, is set at 1.2 for children and 1.5 for parents, and ϵ as the maximum allowable error is set at 0.25, that is, the survey estimate and the overall average maximum error do not exceed 0.25. The minimum sample size was estimated to be 243 children and 379 parents. Considering a 10% non-response rate, 270 children and 422 parents needed to be surveyed.

To compare the cognition of children and parents before and after the lecture, the calculation formula was used, with ϵ set at 0.5. Cognitive scores increased by 0.5 points or more. Other parameters were the same. In total, 61 children and 95 parents were required to be surveyed before and after the lecture. Considering a 10% non-response rate, 68 children and 106 parents were needed. It sampled a maximum number of 270 children and 422 parents, which was the maximum size permitted in this study.

2.2 Survey objects

Primary school students have been reported to have dental trauma at 7 to 9 years. Therefore, this study included firstand second-grade students and their parents from three primary schools in Guangzhou. Primary schools were chosen based on experience and workload. Primary School Affiliated to Guangdong University of Foreign Studies (A School) is the "basic education base" of the Eleventh Five-Year Plan of the Ministry of Education, referring to advanced private education schools. Xiancun Primary School (B School) is a district-level school with the characteristics of Pearl River New City boutique school, representing the district public school. Tiyudong Primary School (C School) is a level school in Guangdong Province, representing provincial public schools. There was almost a complete representation of the Guangzhou population's characteristics in these three primary schools. Inclusion criteria were: (1) All first- and second-graders in the three primary schools and their parents. (2) Could participate in this survey, had normal intellectual development and could complete the questionnaire survey independently or under the guidance of the investigator. Exclusion criteria were: (1) Unable to complete the questionnaire survey independently or under the guidance of the investigator. (2) Questionnaires were not answered by the same parent before and after the lecture.

Informed consent was obtained from the parents before the investigation (**Supplementary material 1**). Finally, 512 pairs of students and their parents who met the inclusion criteria were included in the survey.

2.3 Questionnaire design

There is no ready-made questionnaire for children's dental trauma in China. Therefore, this questionnaire was mainly based on previous studies, including "Knowledge and attitude to dental trauma among mothers in Iraq" [21] and "What do parents know about dental trauma among school-age children?

A pilot study." [22]. The dental trauma questionnaire in the pilot study was based on an oral health questionnaire in the domestic literature entitled "Survey of oral health knowledge, attitude and behavior of mothers of children 3 to 4 years old in Shenzhen" [23]. Sun Yat-sen University's oral epidemiology experts were consulted. The content was modified, supplemented, and improved three times to form a formal questionnaire (**Supplementary materials 2,3,4,5**).

Two questionnaires were administered, one to students and one to parents. The student questionnaire included the student's name, age, class, gender, whether the student had experienced dental trauma, source of dental trauma knowledge, and cognitive score of dental trauma. The parent questionnaire included the parent's name, age, gender, cultural background, whether the student had experienced dental trauma, source of dental trauma knowledge, and cognitive score of dental trauma. Questionnaires were administered before and 1 month after the lecture. Both the pre- and post-lecture questionnaires contained the same information. After the lecture, the questions were rearranged to reduce memory interference.

2.4 Education on dental trauma in children

In September, October and November 2016, 6 face-to-face lectures were given to students and their parents in the three schools. A Microsoft Office PowerPoint (2016 version, Microsoft Corporation, Redmond, Redmond, WA, USA.) presentation was used by the lecturer to offer children's dental trauma education. This included introductions to teeth and tips on how to protect teeth, as well as emergency treatment methods and preventive measures. Each lecture lasted 30 min, using the same PPT presentation. More than 1200 students and their parents (more than 600 pairs) attended the lecture in the three primary schools. (Supplementary Figs. 1,2,3,4,5,6,7)

2.5 Data collection

Each school's dental trauma education supervisor distributed and collected questionnaires. Before and 1 month after the lecture, questionnaires were administered. Each class's supervisor urged the head teacher to improve this work. The head teacher of each class urged students and parents to complete the questionnaire as far as possible to avoid empty papers and incomplete answers. Simultaneously, the school doctor and data collector jointly verified the questionnaire.

2.6 Quality control

Quality control measures were implemented at all stages, from study design to implementation, data collection, results analysis and summary. The main measures are as follows:

(1) The investigation was well organized and arranged. Coordination and communication with the surveyed schools were focused, and lecture times were scheduled. We were successful in distributing and recovering questionnaires.

(2) All lectures were delivered by the same senior community dentist using the same PPT presentation. Ensure perfect public health promotion and education content, the speech content was reviewed many times by children's stomatology experts at Sun Yat-sen University. Thus, the public health promotion and education lectures by community dentists were consistent, comprehensive, and standardized.

(3) The inclusion and exclusion criteria were strictly implemented.

(4) Children and parents were assured of privacy before the investigation, and the results were verified for their authenticity.

(5) The headteacher checked that the questionnaire was collected in time. When the questionnaire was not filled out, the teacher encouraged the participants to complete it as much as possible to ensure high response and completion rates.

(6) Questionnaire validity standards were determined, questionnaire validity was checked one by one before input, and invalid questionnaire numbers were recorded.

(7) The double-entry method of survey data was adopted, and statistical analysis was performed after ensuring that no errors and omissions existed to ensure data entry quality.

2.7 Statistical analysis

After data collection, a database was established using EpiData (3.0, Epidata; Odense, Denmark). Data were double-entered and imported into SPSS for statistical analysis after verification. Data analyses were performed using IBM SPSS Statistics (24.0, IBM, Bent, NY, USA). Continuous variables were presented as mean \pm standard deviation ($\bar{x} \pm s$) or median and interquartile range for nonnormally distributed data, whereas count data were presented as described by frequency numbers and percentages. Using the paired t-test, we compared the cognitive level of children and parents of dental trauma before and after the lecture. The McNemar test was used to compare children's and parents' knowledge of dental trauma before and after the lectures. Factors influencing the improvement in dental trauma cognition of parents and children were analyzed using univariate analysis by independent sample t-test and multivariate analysis by multiple linear regression analysis. Factors influencing dental trauma in children were analyzed by χ^2 inspection. p < 0.05 indicates statistically significant differences.

3. Results

3.1 General situation of the samples

This study included 512 students in grades 1 and 2 from three schools and their parents. Questionnaires were distributed to all students and parents before and 1 month after the lecture. With a 96.88% recovery rate, 496 of the 512 student-parent pairs returned the questionnaires before the lecture. Over twothirds of the questionnaires were deemed valid. Before the lecture, 950 valid questionnaires were collected, with a 92.77% effective recovery rate. 482 student-parent pairs returned the questionnaires 1 month after the lecture, with a 94.14% recovery rate. 944 valid questionnaires were collected, with a 92.19% effective recovery rate. 469 student-parent pairs completed the questionnaire before and 1 month after the lecture. Among them, 8 pairs who answered the same question in the questionnaire before and after the lecture were excluded. Finally, 461 student-parent pairs were included in the analysis, which met sample size requirements.

The students were drawn from three schools with a similar proportion in each school, with more first-graders than second-graders. The proportion of males and females was equal (50.54% and 49.46%), and the average age was 6.85 ± 0.76 years (Table 1).

3.2 Cognitive changes in children and parents before and after lectures

3.2.1 Comparison of children's correct answers to knowledge items before and after the lecture

Before the lecture, 67.25% of children correctly answered that the primary teeth did not need to be put back after trauma. The percentages increased to 75.49% after the lecture. The significant changes are preservation method for lost permanent teeth added 19.52% and golden time for placement of completely lost permanent teeth added 19.96% before and after the lecture. The accuracy of other knowledge items also improved after the lecture (Table 2). A McNemar test was used to compare correct response rates before and after the lecture, revealing statistical differences.

3.2.2 Comparison of parents' correct answers to knowledge items before and after the lecture

Before the lecture, 60.09% of parents correctly answered the preservation method for lost permanent teeth. The percentages increased to 72.23% after the lecture. The significant changes are deal with partial broken teeth and cleaning falling teeth both added 20.61% before and after the lecture. The accuracy of other knowledge items also improved after the lecture (Table 3). A paired sample McNemar test was used to compare correct response rates before and after the lecture, revealing statistical differences.

3.2.3 Changes in cognitive scores of children and parents before and after the lecture

Children's cognitive full score was 8 points, and parents' cognitive full score was 16 points. Children and parents were cognizant of dental trauma to an acceptable level. Children and parents scored significantly higher after the lecture, with an increase of 0.38 points for children and 0.94 points for parents (Table 4).

3.2.4 Changes in the ways to obtain first-aid knowledge of dental trauma before and after the lecture for children

Number of children unaware of dental trauma dropped from 36.66% before the lecture to 0% after (Table 5). After the lecture, the proportion of knowledge obtained through doctors increased significantly from 18% to 42.52%, while the proportion of other routes changed little. A McNemar test was used to compare dental trauma learning before and after the lecture, revealing a statistical difference.

3.2.5 Children's awareness of the location and opening time of dental emergencies near school or home before and after the lecture

Before the lecture, 59.44% of children were unaware of the location and opening time of dental emergencies near school or home. The percentage decreased to 49.89% after the lecture (Table 6). Children who knew the location and opening time of dental emergencies near school or home increased significantly from 40.56% to 50.11% after the lecture. A McNemar test was used to compare the rates before and after the lecture, revealing statistical differences.

3.2.6 Changes in the ways to obtain first-aid knowledge of dental trauma before and after the lecture for parents

Number of parents unaware of dental trauma dropped from 50.33% before the lecture to 0% after (Table 7). The proportion of knowledge obtained through doctors and community education increased slightly from 14.75% and 4.12% before the lecture to 39.05% and 21.47% after the lecture, respectively, while other routes changed little. A McNemar test was used to compare dental trauma learning before and after the lecture, revealing statistical differences.

3.2.7 Parents' awareness of the location and opening time of dental emergencies near school or home before and after the lecture

Before the lecture, 36.88% of parents were unaware of the location and opening time of dental emergencies near school or home. The percentage decreased to 27.11% after the lecture (Table 8). Parents who knew the location and opening time of dental emergencies near school or home increased significantly from 63.12% to 72.89% after the lecture. A McNemar test was used to compare the rates before and after the lecture, revealing statistical differences.

3.3 Analysis of the cognitive influencing factors of children and their parents on children's dental trauma

3.3.1 Analysis of the influencing factors of children's cognition on children's dental trauma

Cognitive scores of children in different schools varied statistically before the lecture. Based on pairwise comparison, students in B School scored lower than those in C School. Students' family economic circumstances and the differing levels of educational resources in these three schools may be responsible for this difference. After the lecture, there was no statistically significant difference in scores between the three schools, and each improved. This indicates that the lecture was effective and the content was basic, universal, and easy to comprehend. Students could gain a basic understanding of health knowledge related to dental trauma through the lecture. The cognitive scores of children with a history of dental trauma were higher than those of children before the lecture. However, no statistically significant differences were observed in the

General run of things	Number $(n = 461)$	Percentage (%)
School		
A: Primary School Affiliated to Guangdong University of Foreign Studies	158	34.27
C: Tiyudong Primary School	182	39.48
B: Xiancun Primary School	121	26.25
Grade		
First grade	303	65.73
Second grade	158	34.27
Children's gender		
Male	233	50.54
Female	228	49.46
Children's age (mean \pm standard deviation), yr	6.85	0.76
History of dental trauma		
Yes	50	10.85
No	411	89.15

ТА	BLE	1.	Frequency	distribution	diagram	of students.
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TABLE 2. Comparison of children's correct answers to knowledge items before and after the lecture.

Knowledge items	Before the lecture	After the lecture	р
Age for children's teeth replacement	438 (95.01%)	438 (95.01%)	1.000
Front teeth are primary or permanent	382 (82.86%)	387 (83.95%)	0.691
The primary teeth did not need to be put back after trauma	310 (67.25%)	348 (75.49%)	0.003
Primary teeth trauma affect permanent teeth	154 (33.41%)	176 (38.18%)	0.176
Deal with partial broken teeth	365 (79.18%)	406 (88.07%)	< 0.001
Deal with completely lost permanent teeth	374 (81.13%)	405 (87.85%)	0.004
Preservation method for lost permanent teeth	218 (47.29%)	308 (66.81%)	< 0.001
Golden time for placement of completely lost permanent teeth	210 (45.55%)	302 (65.51%)	< 0.001

TABLE 3. Comparison of parents' correct answers to knowledge items before and after the lecture.

Knowledge items	Before the lecture	After the lecture	р
The primary teeth did not need to be put back after trauma	226 (49.02%)	294 (63.77%)	< 0.001
Appearance been affected after dental trauma	26 (5.64%)	61 (13.23%)	< 0.001
Primary teeth trauma affect permanent teeth	72 (15.62%)	110 (23.86%)	< 0.001
Age for children's teeth replacement	448 (97.18%)	448 (97.18%)	1.000
Situational question 1 front teeth are primary or permanent	340 (73.75%)	384 (83.31%)	< 0.001
Situational question 2 deal with partial broken teeth	255 (55.31%)	350 (75.92%)	< 0.001
Situational question 3 deal with completely lost permanent teeth	305 (66.16%)	332 (72.02%)	0.023
Situational question 4 cleaning falling teeth	218 (47.29%)	313 (67.92%)	< 0.001
Situational question 5 Preservation of lost teeth	277 (60.09%)	333 (72.23%)	< 0.001

TABLE 4. Changes in cognitive levels before and after the lecture.

Score	Before the lecture	After the lecture	t	р
Children	6.06 ± 1.12	6.45 ± 1.16	5.656	< 0.001
Parents	10.13 ± 1.48	11.07 ± 1.40	32.212	< 0.001

Survey time	Television, Newspapers, etc.	Parent	Doctor	Teacher	Never got it	р
Before the lecture	53 (11.50%)	141 (30.59%)	83 (18.00%)	15 (3.25%)	169 (36.66%)	< 0.001
After the lecture	59 (12.80%)	156 (33.84%)	196 (42.52%)	50 (10.84%)	0	

TABLE 5. First-aid knowledge of dental trauma before and after the lecture for children.

TABLE 6. Children's awareness of the location and opening time of dental emergencies near school or home befor
and after the lecture.

Survey time	Know	Hear nothing of	р
Before the lecture	187 (40.56%)	274 (59.44%)	0.001
After the lecture	231 (50.11%)	230 (49.89%)	

TAE	TABLE 7. First-aid knowledge of dental trauma before and after the lecture for parents.						
Survey time	Television, Newspapers, <i>etc</i> .	Relatives and friends	Doctor	Community education	Never got it	р	
Before the lecture After the lecture	120 (26.03%) 148 (32.10%)	22 (4.77%) 34 (7.38%)	68 (14.75%) 180 (39.05%)	19 (4.12%) 99 (21.47%)	232 (50.33%) 0	0.05	

TABLE 8. Parents' awareness of the location and opening time of dental emergencies near school or home before and

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Survey time	Know	Hear nothing of	р
Before the lecture	291 (63.12%)	170 (36.88%)	< 0.001
After the lecture	336 (72.89%)	125 (27.11%)	

scores between different grades, genders, and dental trauma first-aid knowledge. A correlation was observed between the scores before and after the lecture. The higher the score before the lecture, the higher the score after the lecture (Table 9).

Multiple linear regression analysis was performed using two variables: school and dental trauma history. A School is considered the reference group. Based on the analysis, children from C School scored significantly higher than the reference group. Children without a dental trauma history scored significantly lower than those who did not (Table 10).

3.3.2 Analysis of the influencing factors of parents' cognition on children's dental trauma

Cognitive scores of parents in different schools varied statistically before the lecture. Based on pairwise comparison, parents in B School scored lower than parents in A School and lower than parents in C School. Families' economic circumstances and parents' educational levels may be responsible for these differences. After the lecture, there was no statistically significant difference in parents' scores between the three schools, and each improved. This indicates that the lecture was effective and the content was basic, universal, and easy to comprehend. Parents could gain a basic understanding of health knowledge related to dental trauma through the lecture. Children with a history of dental trauma had higher parental cognitive scores before the lecture than after the lecture. No statistical differences were observed in the scores between different grades, child genders, access to dental trauma knowledge, dental trauma knowledge training, and regular school education (Table 11).

The multiple linear regression analysis revealed that school

and grade were independent factors before the lecture. Parents in C School scored 0.502 points on average, which was significantly higher than parents in A School. Parents in B School scored 0.267 points on average, which was lower than parents in A School. Parents of second-graders scored 0.534 points lower than parents of first-graders. These results are consistent with those found in the children. A multivariate analysis of the scores before and after the lecture revealed statistical significance. The partial regression coefficient indicated that the higher the score before the positive lecture, the higher the score after the lecture. It indicates a one-point increase with a partial regression coefficient of 0.853. The score increased by 0.853 points after the lecture (Table 12).

3.4 Epidemiological investigation of dental trauma

Dental trauma affects approximately 10% of children. Fall injuries accounted for 78.74% of dental traumas. Dental trauma was most common in schools (40.78%). Dental trauma occurred most frequently during school time (57.26%). Dental trauma in schools was most frequently seen in corridors (52.93%). Parents favored permanent tooth trauma prevention over treatment (84.38%). Parents took their children to the dentist most often because they discovered dental disease (55.31%). Parents favored regular dental examinations by dentists (62.91%). Parents favored annual dental knowledge promotion at school (86.98%). Children who suffered tooth trauma were not taken to the hospital because their parents felt it was not serious (59.00%). Parents were the first to help children with dental trauma before and after the lecture (53.36%).

Variable	,	Before the le	ecture	After the lecture	
		$\bar{x} \pm S$	р	$\bar{x} \pm S$	р
School					
А	A School	6.04 ± 1.08		6.54 ± 1.28	
С	C School	6.31 ± 1.08	$< 0.001^{abc}$	6.44 ± 0.98	0.314
В	3 School	5.72 ± 1.14		6.33 ± 1.25	
Grade					
F	irst grade	6.08 ± 1.14	0.720	6.40 ± 1.10	0.105
S	lecond grade	6.04 ± 1.08	0.730	6.54 ± 1.28	0.195
Children's ge	ender				
Ν	/lale	6.03 ± 1.18	0.580	6.43 ± 1.20	0.742
F	emale	6.09 ± 1.05	0.580	6.46 ± 1.13	
History of de	ental trauma				
Y	/es	6.53 ± 0.90	0.002	6.59 ± 1.08	0.250
Ν	lo	6.00 ± 1.13	0.002	6.43 ± 1.17	0.339
Access to de	ntal trauma first-aid knowledge				
Т	elevision and Newspaper	6.01 ± 1.13		6.28 ± 1.10	
Р	arent	6.04 ± 1.14		6.42 ± 1.09	
D	Doctor	6.02 ± 1.13	0.931	6.49 ± 1.28	0.611
Т	Teacher	6.07 ± 0.83		6.81 ± 0.77	
Ν	lever got it	6.12 ± 1.12		0.00	
Scores before	e the lecture	-	-	0.193*	< 0.001

TABLE 9. Analysis of the cognitive factors affecting children with dental trauma.

^a Statistically significant difference between B School and the A School. ^bStatistically significant difference between B School and C School. ^cStatistically significant difference between the A School and C School.

*Regression coefficients of simple linear regression.

A: Primary School Affiliated to Guangdong University of Foreign Studies; B: Xiancun Primary School; C: Tiyudong Primary School.

IADLE IV. N	TABLE 10. Multiple linear regression analysis of cognitive influencing factors in clinuren.						
Variable	Partial regression coefficient	t	р				
School							
A School	Ref						
C School	0.454	3.565	< 0.001				
B School	-0.126	-0.894	0.372				
History of dental trauma							
Yes	Ref						
No	-0.649	-3.648	< 0.001				

TABLE 10. Multi	ple linear regression	analysis of cognitive	influencing factors in children.

Ref indicates reference.

A: Primary School Affiliated to Guangdong University of Foreign Studies; B: Xiancun Primary School; C: Tiyudong Primary School.

4. Discussion

New competitive sports and entertainment options have emerged in our country as society continues to develop. Active play and participation in a variety of sports activities and games are favorites of children, which may impair their limb coordination and independence, leading to children's dental trauma [24]. Oral and maxillofacial injuries are common accidental injuries, 19.7% of children and adolescent dental trauma patients are suffered maxillofacial soft or hard tissue injury, and many patients have dental trauma [25]. Young permanent teeth trauma mostly occurs in children aged 5, 7 and 11 years old, and most 80% traumatized teeth were permanent. The incidence of injury of the anterior teeth has increased due to the prominent facial parts, and the highest incidence of injuries to maxillary central incisors [26].

Variable	v I	Before the lecture		After the lecture			
		$\bar{x} \pm S$	р	$\bar{x} \pm S$	р		
School							
	A School	9.98 ± 1.50		10.95 ± 1.40	$< 0.001^{ac}$		
	C School	10.52 ± 1.37	$< 0.001^{abc}$	11.42 ± 1.36			
	B School	9.74 ± 1.51		10.69 ± 1.36			
Grade							
	First grade	10.21 ± 1.47	0.110	11.13 ± 1.40	0 184		
	Second grade	9.98 ± 1.50	0.119	10.95 ± 1.40	0.104		
Children's	gender						
	Male	10.11 ± 1.47	0 738	11.05 ± 1.40	0.782		
	Female	10.15 ± 1.50	0.758	11.09 ± 1.40	0.782		
History of dental trauma to the child							
	Yes	10.63 ± 1.28	0.014	11.38 ± 1.25	0.110		
	No	10.07 ± 1.50	0.014	11.03 ± 1.41			
Access to first-aid knowledge of dental trauma							
	Television and Newspaper	10.35 ± 1.46		11.25 ± 1.39			
	Parent	9.73 ± 1.83		10.86 ± 1.55			
	Doctor	10.21 ± 1.72	0.140	11.03 ± 1.54	0.443		
	Teacher	9.63 ± 1.50		10.74 ± 1.33			
	Never got it	10.07 ± 1.37		0.00			
First-aid training for dental trauma							
	Not have	9.59 ± 1.34	0.052	10.72 ± 1.14	0 162		
	Have	10.16 ± 1.49	0.052	11.09 ± 1.41	0.102		
In favor of regular school education							
	Approve of 10.21 ± 1.52		<0.001	11.12 ± 1.43	0.002		
	Disfavor	9.61 ± 1.11	<0.001	10.73 ± 1.13	0.002		
Scores before the lecture		-	-	0.856*	< 0.001		

TABLE 11. Analysis of parental cognitive factors influencing dental trauma in children.

^aSignificant difference between B School and A School. ^bSignificant difference between B School and C School. ^cSignificant difference between A School and C School.

*Regression coefficients of simple linear regression.

A: Primary School Affiliated to Guangdong University of Foreign Studies; B: Xiancun Primary School; C: Tiyudong Primary School.

Children's dental trauma impacts their dental health as well as their growth and development. There have been reports abroad that dental trauma incidence varies by region. Dental trauma has been reported in approximately 44% of Ha'il, Saudi Arabia [27]. New Zealand reports 23.4% prevalence of traumatic dental injuries [28]. About 8.2% preschool children in multicultural areas of Stockholm, Sweden had experienced dental trauma [29]. Asia and the Pacific region have reported 6% to 19% of anterior tooth trauma, and Brazil has reported 20.2% [30]. Middle incisors are most commonly affected. Differences in design, diagnostic criteria, and geographical and cultural characteristics may explain such a large difference.

Constant tooth trauma not only affects the appearance, function, normal eruption of adjacent teeth, and arrangement of teeth but also affects children's psychological, behavioral and personality development, reduces their quality of life, and impact their parents and families [31, 32]. Dental trauma must therefore be treated as soon as possible. However, a foreign questionnaire survey of primary school parents about tooth trauma showed parents' lack of awareness, knowledge and skills about tooth trauma [33]. In China, children's dental trauma has not been given much attention, and even routine oral examinations for exercise participants do not assess the risk of dental trauma. The high incidence of dental trauma and low public awareness have prompted countries to investigate ways to reduce it. Some countries have started using posters and electronic mobile devices to deepen the knowledge of dental trauma, some call for more training of dentists and nurses in dental trauma, and some suggest wearing mouthguards [34].

Variable		Before the lecture		After the lecture			
		Partial regression coefficient	t	р	Partial regression coefficient	t	р
School							
	A School	Ref			Ref		
	C School	0.502	3.178	0.002	0.019	0.290	0.772
	B School	-0.267	-1.528	0.127	-0.054	-0.751	0.453
Grade							
	First grade	Ref					
	Second grade	-0.534	-2.411	0.016			
First-aid training for dental trauma							
	Not have	Ref					
	Have	0.479	1.666	0.096			
Support regular school education							
	Approve of	Ref					
	Disfavor	-0.026	-0.662	0.508	0.007	0.409	0.683
Scores before th	e lecture				0.853	44.796	< 0.001

TABLE 12. Multiple linear regression analysis of the factors influencing parental cognition.

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Domestic tooth trauma-related work has started. However, children's tooth trauma education courses are lacking, and students, teachers, and parents lack knowledge about tooth trauma, emergency treatment skills, and prevention of tooth trauma [35]. Consequently, children can suffer huge physical and psychological trauma if the best treatment is delayed [36, 37].

Preventive measures from an early age and early recourse would be favourable [38]. To improve public awareness and education about children's dental trauma, oral health professionals should develop various methods to strengthen oral health publicity and education. Some professionals use an instructional video presentation to improve the oral health knowledge of new mothers [39]. And an educational cartoon animation on the knowledge of children about traumatic dental injuries also effective [40]. Basic community hospitals bear the mission of primary prevention, and community doctors are the first to be the best candidates for publicity. However, only a little study has been conducted on the influence of community doctors in China [41, 42].

Community dentists provide targeted education on patients' problems during their daily visits. It is, however, too scattered. Additionally, community dentistry covers a wide range of diseases. Despite this, dental trauma clinic visits are not common [43]. Individualized education has a good effect, but it is not good for popularizing dental trauma awareness among children.

According to the literature, tooth trauma commonly occurs in children aged 7–9 years. A statistical analysis of this questionnaire survey indicated that children's cognitive abilities were not significantly influenced by their age.

Oral health knowledge lectures were given by community

dentists to children and parents to promote dental trauma knowledge. This study examined dental trauma knowledge among students and their parents, both improved after the lecture.

4.1 The cognition level of both children and their parents improved after the lecture

The questionnaire survey showed that the correct response rates of children and parents after the lecture on whether the primary teeth should be returned to the original alveolar socket, the choice of preservation method for lost permanent teeth, and the golden time for placement of lost permanent teeth were all higher than those before the lecture. Compared to before the lecture, children and their parents had a higher average knowledge score about pediatric dental trauma after the lecture, suggesting that the lecture was effective. Community dentists brought dental trauma in children to children and their parents' attention. Most children and parents already know that when a child has broken or completely lost teeth, timely dental visits can bring a better prognosis to the affected teeth. Parents and students have mastered the golden treatment time of dental trauma and basic dental trauma management skills. Researchers in Italian have also suggested education programs to improve awareness of dental trauma [44].

It's crucial to choose the right immediate treatment method when trauma occurs to the young permanent anterior teeth. Clinical examinations and diagnoses must be used to develop a proper diagnosis and treatment plan, including immediate treatment, transitional treatment, and final treatment. According to the guidelines for dental trauma treatment at home and abroad, the best replanting time for complete dislocation of young permanent teeth is within 15 min, periodontal cells may be necrotic after drying for more than 60 min [45]. With community dentists mastering trauma permanent teeth treatment technology and health resources distributed reasonably, our country gradually advocates and encourages the public to seek treatment at nearby community hospitals. Currently, Chinese community dentists cannot treat children with dental trauma in one step. However, they play an important role in public health education. To prevent diseases, they can use their health resources to develop targeted education for the corresponding population. In this study, the behavior of some parents and children changed after the dental trauma lecture. Their awareness of the opening time and location of dental clinics near their homes increased, indicating that health education intervention has immediate effect. Foreign literature had also confirmed that oral education had a positive effect on preventing oral diseases [46]. Compared with posters, brochures, and other publicity methods to improve public awareness of children's dental trauma, the face-to-face lectures given by community dentists used in this study are more effective, economical, and suitable for China's national conditions, and it is worth popularizing and using at grassroots.

4.2 Analysis of cognitive influencing factors before and after lectures

The results of univariate and multivariate analyses showed statistical differences in scores before the lecture between different schools, children with a history of dental trauma, and the level of first-aid training for dental trauma. Based on pairwise comparison, parents in B School scored lower than parents in A School and lower than parents in C School. Families' economic circumstances and parents' educational levels may be responsible for these differences [47]. Children with a history of dental trauma and their parents had higher cognitive scores before the lecture than those without a history. However, the difference was not statistically significant after the lecture. It is possible that children with dental trauma and their parents were aware of dental trauma before this lecture, so the score is higher than that of parents of children without dental trauma. After the lecture, all children and parents became more aware of dental trauma, so their scores did not differ statistically. This study indicates that the lecture was effective and the content was basic, universal, simple, and easy to understand. Through the lecture, both students and parents can have a basic understanding of the health knowledge related to dental trauma.

4.3 Epidemiological investigation of dental trauma

This study showed that the incidence of dental trauma in children is high. This finding is consistent with domestic and foreign literature reports [48]. Trauma to the front teeth of first- or second-grade students can affect their physical and mental health. However, this study showed that when children have tooth trauma, 59.00% of parents do not take their children to the hospital because they feel it is not severe. Furthermore, approximately 53.36% of parents were the first to help children with the wound. In spite of this, only 58.6% of parents have been trained in children's dental trauma, and

proper treatment on the site is making people very anxious about the outcome. In Guangzhou, it can be seen that the etiology and prevention of dental trauma in children have not received much attention from children and parents, and their cognition of children's dental trauma is low. The need to strengthen their understanding of dental trauma has become very urgent.

Also, schools were found to be a common site for dental trauma. Children are most likely to suffer dental trauma during school time (57.26%), and they are most likely to have dental trauma in school corridors (52.93%). Publicity and prevention are important in schools [49], as well as teaching students not to chase and fight and paying attention to staircase safety. Also, dental trauma knowledge and emergency treatment training in schools is very important.

Parents believe that permanent tooth trauma prevention is more valuable than treatment. They favor doing dental knowledge publicity in school every year and hope to listen to more such lectures, which indicates that parents' demand and awareness of dental trauma knowledge have improved.

4.4 Prevention and treatment of dental trauma in children

This study showed that approximately 10% of primary school first- and second-graders in Guangzhou have a history of dental trauma, and the incidence is high. Dental trauma can also affect children's appearance, speech, mood, and even their quality of life in addition to causing pain and infection [50]. Although the loss caused by dental trauma has attracted the attention of many parents and dentists, the etiology and prevention of dental trauma are not as important as caries and periodontal disease, and the risk assessment for dental trauma is not done during routine oral examinations for people participating in various exercises.

In this study, face-to-face lectures on children's dental trauma were delivered. The lecture content was basic, universal, and scientific. Students' and parents' knowledge of children's dental trauma improved after the lectures in varying degrees, and their health behavior changed. Such lectures in Guangzhou are effective, as they provide an objective basis for preventing and treating children's dental trauma in primary oral healthcare. They also provide a clinical basis for monitoring and preventing oral diseases and serve as reference materials for effective oral health education.

4.5 The limitations of the manuscript

This survey only studied the influence of dentists in one district of Guangzhou on dental trauma education, and did not extend to other areas. Therefore, the results cannot represent the overall situation of Guangzhou. We hope to continue to expand the research scope in the future, conduct more in-depth studies on this topic, and provide more accurate and reliable results.

5. Conclusions

After educational intervention, knowledge improved significantly. After the lecture, 63.77% of parents knew that primary teeth should not be reinserted into the alveolus after trauma, compared to 49.02% before the lecture (p < 0.001). Additionally, avulsed permanent teeth preservation awareness increased from 60.09% to 72.23% among parents (p < 0.001). We demonstrate that community dentist-led education effectively enhances both children's and parents' understanding of dental trauma, which is crucial to effective prevention and management.

Because the survey does not cover all the urban areas of Guangzhou, so the results can not represent the situation of Guangzhou, we hope to study this topic in the future, provide more accurate and reliable results.

ABBREVIATIONS

PPT, Microsoft Office PowerPoint; A School, Primary School Affiliated to Guangdong University of Foreign Studies; B School, Xiancun Primary School; C School, Tiyudong Primary School.

AVAILABILITY OF DATA AND MATERIALS

The statistical data contains personal information, which cannot be publicized without the consent of the students and their parents. Informed consent, students and parents' questionnaires, photos of the lecture site and some PPT of the lecture, are provided for reference.

AUTHOR CONTRIBUTIONS

XHZ and PHZ—designed the research study. XHZ performed the research; wrote the manuscript. PHZ provided help and advice on methods of oral epidemiological investigation and statistics; analyzed the data. Both authors contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

We have committed to all parents who participated in this survey that all data will be used only for scientific research and will be anonymous. Informed consent has also been obtained. The ethics approval number: Xian Wei ethics review No. 3 of 2016. Xiancun Street Community Health Service Center is a public community and a medical institution under the Tianhe District Health Commission. Its ethics committee is approved by the higher-level medical institution and can exercise ethical approval functions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.jocpd.com/ files/article/1940473349032296448/attachment/ Supplementary%20material.docx.

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