

COMMON CAUSES OF CUSP FRACTURE IN ADULTS; A SYSTEMATIC REVIEW

Omar Mohammed AlShehri^{1*}, Nasser Mohammed Jali², Yasser Mansour Almutairi³, Mohammed Mohsin Aljrais⁴, Abdullah Mushabbab Alsirhani⁵, Ahmed Saad AlQudairi⁴

¹Department of Endodontics, Ministry of Interior, Security Forces Hospital, Specialist Polyclinics Western Riyadh, KSA. Dr.omaralsheri@gmail.com

²Dental Laboratory, Security Forces Hospital, Riyadh, KSA.

³Department of Dentistry, Ministry of Interior, Security Forces Hospital, Riyadh, KSA.

⁴Department of Dentistry, Security Forces Hospital, Riyadh, KSA.

⁵Department of Restorative Dentistry, Prince Sultan Military Medical City, Riyadh, KSA.

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ABSTRACT

Cusp fractures take place regularly in root canal treated teeth with huge restorations and no cusp protection. These cracks frequently lead to perplexing clinical decisions, for instance, whether to carry out intricate restorative treatment or extraction of the fractured teeth. Traumatic dental injuries may occur due to either a direct or indirect impact. The extent of the harm comes from the energy, direction, and form of the impacting item and the reaction of the tissues neighboring the tooth. A systematic literature review was conducted from 2012 to 2022 was performed using databases such as PubMed, Medline and ScienceDirect. The key words used were “cusp fractures”, “tooth trauma”, “cracked tooth”. PRISMA flowchart was used to describe the selection process of searched articles. We found A total of six studies were included in the systematic review of which three documented falls and injuries as the most common cause of cusp fracture. Most common reasons for cusp fracture are noted to be trauma, whereas the occlusal stress or restoration related fractures are less common.

Key words: Cusp fracture, Systematic review, Tooth trauma, Cracked tooth.

Introduction

Cusp fractures take place regularly in root canal treated teeth with huge restorations and no cusp protection. These cracks frequently lead to perplexing clinical decisions, for instance, whether to carry out intricate restorative treatment or extraction of the fractured teeth [1, 2]. Incomplete and complete non-traumatic tooth fractures usually happen in the coronal-apical course, which is related to masticatory forces. Longitudinal tooth fractures can appear with several symptoms ranging from pain on chewing and/or sensitivity to cold, to inexplicable impulsive pain [3, 4].

The cusp fracture in posterior teeth and management to avoid such fractures comprise significant portions within a dental practice. In a cross-sectional among North Carolina general practitioners, they reported witnessing an average of more than 12 patients per month with complete fractures of cusps of posterior teeth, which comprised more than 5% of all non-hygiene appointments to their practice. These fractures were allegedly the most common kind, with incomplete coronal fractures, stated at a rate of around seven per month. It was also revealed that many clinicians were incapable to propose even indefinite approximations of what percentage of patients can anticipate experiencing cusp fracture in a year, let alone the incidence rates for particular teeth. Although awareness of these rates will not lead to explicit evaluation of the risk of fracture for individual patients, it does deliver evidence that may be

beneficial in assisting both dentists and their patients comprehend how frequently fractures occur generally and for specific teeth [5, 6].

Traumatic dental injuries may occur due to either a direct or indirect impact. The extent of the harm comes from the energy, direction, and form of the impacting item and the reaction of the tissues neighboring the tooth. Falls is the most frequently occurring cause of dental trauma, comprising up to 65% of cases, followed by sports injuries, cycling mishaps, car accidents, and physical fight [7]. The occurrence of traumas connected with sports and violence upsurges with age, the prior being more common in teenagers and the latter in adults. By comparison, falls and impacts are the most frequently occurring cause of dental trauma in primary dentition. Dental caries are an influencing element for tooth fracture even after the smallest amount of trauma [7, 8].

Aims of the study

The purpose of this systematic review was to determine the causes of cusp fractures in adults.

Materials and Methods

A systematic literature review from 2012 to 2022 was performed using databases such as PubMed, Medline, and Scencedirect. The keywords used were “cusp fractures”, “tooth trauma”, “cracked tooth” (**Table 1**). PRISMA

flowchart was used to describe the selection process of searched articles (**Figure 1**).

Table 1. Inclusion and exclusion criteria

Nº	Inclusion criteria	Exclusion criteria
1.	Cross-sectional studies, case reports, case series reviews.	Clinical trials or experimental studies.
2.	Published between 2010 and 2022	Out of the specified time range
3.	Studies including cusp fractures or trauma	Studies other than cusp fractures or trauma
4.	English language of publication	Language other than English

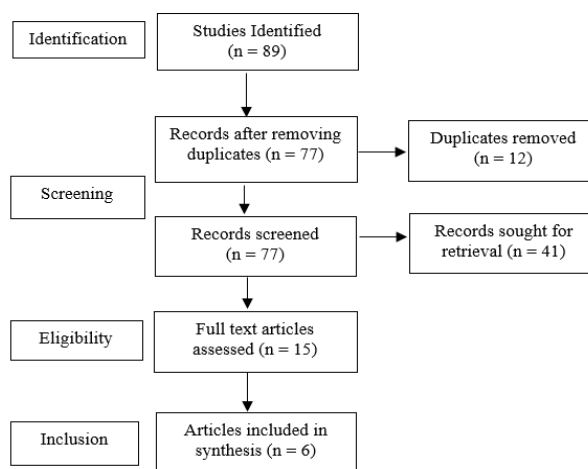


Figure 1. PRISMA Flow Diagram

Risk of bias assessment

The Cochrane Risk of bias assessment method was used to assess the quality of the studies included (**Table 2**).

Table 2. Summary of Cochrane Risk of Bias Assessment

Study	Selection Bias/Appropriate control selection/baseline characteristics similarity	Selection bias in randomization	Selection bias in allocation concealment	Performance-related bias in blinding	Reporting bias/Selective reporting of outcomes	Detection bias Blinding outcome assessors	Accounting for confounding bias
[9]	+	+	+	+	+	+	-
[10]	+	+	+	+	-	+	-
[11]	+	+	+	+	+	-	+
[12]	+	+	+	+	+	+	-
[13]	+	-	+	+	+	+	+
[14]	+	+	+	-	+	+	+

Results and Discussion

Table 3. Findings observed from the selected studies according to the inclusion criteria

Author/year	Study type	Methodology	Outcome
Zaleckiene <i>et al.</i> (2014)	Systematic review	Data collected from databases such as Medline, Cochrane and Science citation index.	Most common cause of cusp fracture was fall.
Goel <i>et al.</i> , (2020)	Case report	A case of 17 year old patient with fractured cusp.	Fractured cusp was caused by caries.
Li <i>et al.</i> , (2021)	Narrative review	Articles were downloaded from PubMed, Embase and Medline databases.	Increased forces of mastication and sleep bruxism cause cusp fracture.
Morimoto <i>et al.</i> , (2021)	Cross-sectional study	Patients with cusp fractures were interrogated using a questionnaire.	Restorations having isthmus wider than 1/3 of the intercuspid distance.

Hecova <i>et al.</i> , (2010)	Retrospective study	Patients' documents were studied.	Most common cause of cusp fracture was sports injuries.
Tang <i>et al.</i> , (2010).	Narrative review	Articles studied from PubMed.	Functional and repeated overloading stress was common cause of cusp fracture.

This systematic review explored the etiologies of cusp fractures presented in six different articles selected systemically. **Table 3** shows the description of the findings associated with all the included studies. One of the risk factors listed was dental caries, which are often challenging to identify by simple visual and palpable methods. Missed caries can frequently be troublesome and require extensive management at later phases. It is therefore vital to detect dental caries at initial times. Additional methods including X-rays etc. must be regularly utilized in patients deemed to be at risk [10].

Accidental dental injuries are documented as public dental health complications universally. A trend of an upsurge in the occurrence of dental traumas because of more interest in sports events can be perceived. Furthermore, the varying routines and necessities of current society result in the appearance of new forms of dental injury. Therefore, a systematic update of awareness in dental traumatology is essential [9]. Dental injuries challenge dental practitioners rather frequently in their dental practices. The stated occurrence of traumatic dental injuries for one year ranges between 1.5% and 2.8% where frequent etiological factors include falls, sports, and traffic accidents [13].

Complete comprehension of the causes of cusp fracture is an imperative requirement for its avoidance, diagnosis, and treatment. The affecting elements for cusp fractures are factors that escalate the force exerting on the teeth or the others that weaken the strength of the teeth towards masticatory force. The etiology of cusp fracture is widespread and is associated with non-iatrogenic and iatrogenic aspects that prescribe the intervention needed. Whereas the former comprises growing and functional status as well as pathological progressions, the latter includes the odontiatrogenic factors [11].

Morimoto *et al.*, (2021) reported that fractures were prevalent frequently in teeth having restorations with the isthmus wider than 1/3 of the intercuspid distance and/or comprised of more than 3 restored surfaces [12]. Generally, lower than 1% of sound teeth fractured, strengthening the idea that teeth experiencing cavity preparation are weakened and disposed to fracture. This may be associated with the point that cusp deflection escalates with cavity dimensions, triggering fatigue of the dental tissue over time, leading to microleakage and dental fractures. Proximal box preparation considerably deteriorates the whole dental structure and additionally increases the chance of fractures because of marginal ridge loss.

The reasons for cusp fracture have been extensively advocated as abrupt impact trauma taking place from epileptic fits and laryngoscope misapplication and fatigue failure of tooth structure caused by recurrent stress overloading. Usual functional stresses may cause cusp fractures in occasions of lower mechanical properties, from reduced tooth structure resulting from caries, tooth wear, and operative dentistry techniques, and from fluctuations in tooth structure due to aging, vital pulp tissue loss, and endodontic treatment [14, 15].

Conclusion

The most common reasons for cusp fracture are noted to be trauma, whereas the occlusal stress or restoration related fractures are less common.

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