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Risk factors associated with traumatic dental injuries in the geriatric population: A case-control study

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Abstract:
With the growing elderly population, traumatic dental injuries are emerging as an important public health concern because they are associated with falls, systemic disease, balance problems and poor oral health. This case-control study included 20 elderly cases with traumatic dental injuries and 20 age- and sex-matched controls without injuries to evaluate risk factors using a structured questionnaire and clinical examination. Chi-square and multivariate logistic regression analyses showed significant associations between traumatic dental injuries and history of falls, visual impairment, polypharmacy, impaired mobility, osteoporosis and denture instability. Falls were the most common cause, the maxillary anterior teeth were most frequently affected and crown fracture was the predominant injury pattern. This study identifies modifiable geriatric risk factors for traumatic dental injuries and supports fall prevention, oral health promotion and regular dental review to reduce injury burden in older adults.

Keywords: Traumatic dental injuries (TDIs), geriatric dentistry, elderly, falls, risk factors, dental trauma, oral health, case-control study

Background:
Traumatic dental injuries (TDIs) are injuries to the teeth and surrounding oral tissues that result from an external impact. While TDIs are more frequently studied in children and adolescents, the growing life expectancy and the increasing geriatric population have drawn attention to dental trauma in the elderly. The elderly are especially at risk for traumatic injury due to the effects of aging, chronic disease, decreased balance, visual problems, loss of neuromuscular control and side effects of medications **[1]**. Globally, the elderly population is rapidly increasing. The number of people aged 60 and over is projected to increase significantly in the coming 20 years. Multiple chronic conditions are associated with aging, such as osteoporosis, diabetes mellitus, hypertension, arthritis, Parkinsonism, cognitive decline and visual impairment, which all increase the risk of falls and traumatic injuries. Falls continue to be the most common cause of morbidity in older people and are often complicated by oro-facial trauma and dental injuries **[2, 3]**. The nature of traumatic dental injuries in elderly people is very different from that in younger people. Periodontal attachment loss, decreased bone density, root caries, restorations and prosthetic rehabilitation make the teeth more fragile and make the prognosis after trauma more difficult in geriatric patients. In addition, impaired healing is due to decreased vascularity and systemic comorbidities. Elderly people may be taking several medications such as antihypertensive, sedatives, antidepressants and anticoagulants and these can make them dizzier, make them more likely to develop postural hypotension and make them more likely to bleed after an injury **[4]**. Several studies have demonstrated that falls are the predominant cause of dental trauma in older adults. Occurrence of injuries is also related to environmental hazards like slippery floors, poor lighting, uneven surfaces and the absence of assistive devices. Other risk factors include visual impairment, impaired gait, cognitive dysfunction, alcohol use and neuromuscular disorders **[5, 6]**. Elderly patients can have a significant impairment in their quality of life due to traumatic dental injuries. Mastication, speech and swallowing functional limitations may occur after tooth fracture or avulsion. Psychological distress and diminished self-esteem may be caused by esthetic issues and social embarrassment. Treatment, restorative measures and long-term rehabilitation may also impact elderly patients, especially those with low income, due to the economic costs involved **[7-9].** Although there has been an increased awareness of geriatric trauma, there is little literature available on risk factors specifically related to traumatic dental injuries in elderly patients, especially in developing countries. Epidemiological studies tend to concentrate on children or adolescents. The identification of modifiable risk factors in elderly people can help to guide the planning of preventive strategies to lower the incidence of dental trauma and enhance oral health outcomes **[10-12].** Therefore, it is of interest to assess the various demographic, medical, behavioural and oral health related risk factors associated with traumatic dental injuries in geriatric population visiting a tertiary dental care center.

Materials and Methodology:

This was a case-control study carried out in the Department of Oral Medicine and Radiology in association with the Department of Prosthodontics and Geriatric Medicine in a tertiary care teaching hospital for 18 months following approval by the Institutional Ethics Committee. All participants gave written informed consent prior to entering the study. A total of 200 participants aged 60 years and above were included in the study. The study population was split into two groups: 100 cases and 100 controls. Patients older than 60 years with traumatic dental injuries, diagnosed clinically and radio graphically, were included in the cases. Age and sex matched elderly people who did not have any history or evidence of traumatic dental injuries and were attending the outpatient department for routine dental treatments were included in the controls. Severe psychiatric illness, terminal systemic disease, inability to communicate effectively and completely edentulous patients were excluded from the study. Those who refused to take part were also not included. Demographic data, such as age, sex, place of living, socio-economic status and educational level, were collected. A detailed medical history of hypertension, diabetes mellitus, osteoporosis, Parkinsonism, arthritis, visual impairment, hearing impairment, neurological disorders and medication history was recorded. Special focus was placed on the use of five or more medications per day (polypharmacy). Structured interviews were used to assess behavioural factors such as tobacco use, alcohol consumption, physical activity level and history of falls in the past year. Data on mobility, walking aids, balance problems and hazards at home were also gathered. Examination was done clinically with proper illumination and sterile instruments. Oral hygiene status, periodontal condition, denture use, denture stability, missing teeth, root caries, occlusal abnormalities and the prosthetic status were assessed. Traumatic dental injuries were classified as per Andresen's classification based on the type and location of the injury. Intraoral periodical and panoramic radiographs were taken when necessary. The data were entered into Microsoft Excel and analyzed by SPSS software version 25. The descriptive statistics used were mean, standard deviation, frequency and percentage. Chi-square test was used for comparison between categorical variables. Independent t-test was used for continuous variables. Multivariate logistic regression was used to determine independent risk factors for traumatic dental injuries. The p value was considered statistically significant if it was < 0.05.

Results:

A total of 200 geriatric participants were included, with 100 cases of traumatic dental injuries and 100 age- and sex-matched controls without injuries. As shown in (**Table 1)** cases had a significantly higher prevalence of history of falls (63% vs 28%, p < 0.001), visual impairment (56% vs 29%, p < 0.001), osteoporosis (41% vs 18%, p = 0.001), polypharmacy (52% vs 25%, p < 0.001), impaired mobility (49% vs 22%, p < 0.001) and alcohol use (32% vs 18%, p = 0.022), whereas diabetes mellitus and hypertension were not significantly different between groups. As shown in (**Table 2)** poor oral hygiene (58% vs 34%, p = 0.001), periodontal disease (62% vs 39%, p = 0.002), denture use (47% vs 31%, p = 0.019), unstable dentures (36% vs 12%, p < 0.001), missing teeth >5 (51% vs 37%, p = 0.046) and root caries (43% vs 24%, p = 0.004) were significantly more common among cases than controls, while tobacco use was not significantly associated with traumatic dental injuries. Among the traumatic dental injuries observed, uncomplicated crown fractures were the most common (38%), followed by complicated crown fractures (24%), luxation injuries (19%), root fractures (11%) and avulsion injuries (8%). Multivariate logistic regression analysis in (**Table 3)** showed that previous history of falls was the strongest independent risk factor for traumatic dental injuries (OR 3.84, 95% CI 2.01–7.12, p < 0.001), followed by visual impairment (OR 2.61, 95% CI 1.42–4.89, p = 0.002), polypharmacy (OR 2.94, 95% CI 1.57–5.46, p < 0.001) and impaired mobility (OR 2.73, 95% CI 1.39–5.11, p = 0.003).

Table 1: Demographic and medical risk factors associated with traumatic dental injuries

Variable	Cases (n=100)	Controls (n=100)	p-value
History of falls	63 (63%)	28 (28%)	<0.001*
Visual impairment	56 (56%)	29 (29%)	<0.001*
Osteoporosis	41 (41%)	18 (18%)	0.001*
Polypharmacy	52 (52%)	25 (25%)	<0.001*
Impaired mobility	49 (49%)	22 (22%)	<0.001*
Diabetes mellitus	44 (44%)	36 (36%)	0.247
Hypertension	61 (61%)	55 (55%)	0.392
Alcohol use	32 (32%)	18 (18%)	0.022*

Table 2: Oral health and prosthetic factors associated with traumatic dental injuries

Variable	Cases (n=100)	Controls (n=100)	p-value
Poor oral hygiene	58 (58%)	34 (34%)	0.001*
Periodontal disease	62 (62%)	39 (39%)	0.002*
Denture use	47 (47%)	31 (31%)	0.019*
Unstable dentures	36 (36%)	12 (12%)	<0.001*
Missing teeth (>5)	51 (51%)	37 (37%)	0.046*
Root caries	43 (43%)	24 (24%)	0.004*
Tobacco use	39 (39%)	30 (30%)	0.176

Table 3: Logistic regression analysis of independent risk factors

Risk Factor	Odds Ratio (OR)	95% Confidence Interval	p-value
History of falls	3.84	2.01–7.12	<0.001*
Visual impairment	2.61	1.42–4.89	0.002*
Polypharmacy	2.94	1.57–5.46	<0.001*
Impaired mobility	2.73	1.39–5.11	0.003*
Unstable dentures	3.16	1.48–6.71	0.001*
Osteoporosis	2.08	1.04–4.16	0.038*

Discussion:

The aging of the world's population and the increasing prevalence of chronic systemic diseases among older adults are contributing to TDIs being recognized as an important oral health problem. The elderly are especially vulnerable to trauma because of their decreased balance, reflexes, neuromuscular coordination, vision, osteoporosis and multiple comorbidities. The present case-control study examined demographic, systemic, behavioural and oral health-related risk factors for traumatic dental injuries in persons 60 years of age and older. Previous studies by Razak *et al.* highlighted the fact that geriatric oral health is often affected due to the cumulative oral disease burden, tooth loss, periodontal destruction and prosthetic dependency, which may make geriatric patients more

susceptible to traumatic injuries **[13]**. Later, Petti *et al.* performed a global meta-analysis and found that traumatic dental injuries are a significant public health problem in the world, impacting almost one billion people and that older adults are at higher risk due to the rising life expectancy and fall-related injuries **[**8**]**. Lam *et al.* also pointed out that traumatic dental injury can cause significant functional, esthetic, psychological and economic consequences, especially in the elderly population who are medically compromised **[1]**. Falls were found to be the most prevalent etiological factor in the present study that was associated with traumatic dental injuries. This is similar to the results found by Ramachandran *et al.*, who noted that one of the most common causes of dental trauma in adults and elderly was accidental falls **[6]**. Physiological changes with age, such as decreased gait stability, muscle weakness, decreased protective reflexes and decreased postural control, significantly increase the risk of oro-facial trauma associated with falls. In line with this, Arroyo Bote *et al.* reported that falls in geriatric patients often lead to complicated dental injuries and oro-facial complications that necessitate multidisciplinary care **[2]**. The present study revealed that visual impairment was a major independent risk factor. Cataracts, glaucoma, diabetic retinopathy and macular degeneration are common conditions among older people that affect their ability to see depth and orientation, which can lead to falls and injuries. Murali *et al.* highlighted the impact of sensory impairment and restricted access to geriatric oral health services on oral outcomes among older adults **[9]**. Wang *et al.* also showed a significant link between poor oral health and falls among community-dwelling older adults, highlighting the relationship between systemic frailty, mobility limitations and oral trauma risk **[14]**. Another significant risk factor found in the present study was polypharmacy. Older people often need to take several medicines to treat chronic systemic conditions like hypertension, diabetes mellitus, cardiovascular conditions, arthritis and neurological conditions. Dizziness, postural hypotension, impaired cognition and reduced psychomotor coordination are potential side effects of several medications, such as sedatives, antidepressants, antihypertensive, anxiolytics and anticonvulsants, which can make an individual more susceptible to falling. Srivastava *et al.* highlighted that elderly patients with medical conditions need special dental care as systemic diseases and medication-related complications have a significant impact on oral health outcomes and trauma risk **[12]**. The same was noted by Jabeen *et al.*, who reported that medication-induced balance disturbance and impaired mobility are significant factors in traumatic injuries in elderly people visiting oral healthcare centres **[5]**. The present study also demonstrated significant association between osteoporosis and traumatic dental injuries. The decreased bone mineral density makes the trauma worse and slows down healing after an injury, affecting both the alveolar bone and the skeletal bone. Elderly people may be susceptible to luxation injuries and tooth fractures with relatively minor trauma due to the presence of osteoporotic changes in the alveolar bone. Nakamura *et al.* showed that the relationship between tooth loss and dietary compromise is closely associated with systemic degeneration and cognitive decline in elderly people, suggesting that the oral status of elderly people is associated with their overall health **[15]**. Oral health-related variables that were significantly associated with traumatic dental injuries were periodontal disease, missing teeth, poor oral hygiene, unstable dentures and prosthetic rehabilitation. In elderly people with severe periodontal destruction, there is a decrease in periodontal support and increase in tooth mobility, which makes teeth more susceptible to displacement and fracture during trauma. Dentures that are not well-fitting or stable can affect masticatory efficiency and also raise the risk of accidental falls. Razak *et al.* had earlier highlighted that poor oral hygiene and inadequate prosthetic care are still very common among the elderly, due to physical constraints and limited access to oral health care services **[13]**. In the present study, the most frequently involved teeth were the maxillary anterior teeth and the most frequent type of injury was a crown fracture. Epidemiological studies by Tiwari and Suresh showed that anterior teeth are especially susceptible due to their exposure during impact injury and prominent position in the dental arch **[7]**. Crown fractures and luxation injuries are also the most common traumatic injuries seen in adults as per the International Association of Dental Traumatology **[**IADT**]** guidelines **[10, 11]**. Traumatic dental injuries in the elderly can have significant psychosocial implications. Dental trauma can affect mastication, speech, aesthetics and social interaction, which can have a negative impact on quality of life and psychological well-being. Older patients may also have nutritional problems due to decreased chewing function after trauma. Kambakhsh *et al.* highlighted the need for multidisciplinary rehabilitation strategies such as restorative treatment, prosthetic rehabilitation, nutritional counselling and psychosocial support for elderly trauma patients **[4]**. The results of this study highlight the importance of comprehensive preventive measures to minimize traumatic dental injuries caused by falls in elderly persons. Periodic dental assessment, physiotherapy, balance training, medication review, home hazard modification and regular ophthalmologic evaluation can greatly decrease the risk of trauma. Programs of preventive oral health care emphasizing periodontal maintenance, prosthetic stability and patient education should be incorporated into geriatric health care services. Moreover, the interdisciplinary cooperation of dentists, physicians, physiotherapists, geriatricians and caregivers is crucial for successful prevention and management of traumatic dental injuries in the elderly. The present study had a hospital-based design and this may not fully reflect the general elderly population. The results may also have been affected by recall bias for fall history and trauma occurrence. The study, however, offers useful information on several modifiable risk factors for geriatric people with traumatic dental injury and emphasizes the need for preventive multidisciplinary care approaches.

Conclusion:

Falls, visual impairment, polypharmacy, impaired mobility, osteoporosis, unstable dentures and poor oral health status are strong risk factors for traumatic dental injuries among geriatric

patients. Falls continue to be the most common cause. Multidisciplinary preventive strategies for the early identification and modification of these risk factors can greatly decrease the impact of dental trauma in the elderly population and enhance their quality of life.

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