

Knowledge of Dental Interns towards Emergency Management of Avulsed Tooth in Dental Colleges in Nepal

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ABSTRACT

Background: Avulsion is most common traumatic injury of tooth. Adequate knowledge about management of this situation can save a tooth. This study was conducted to investigate the knowledge and attitude of dental interns of Nepal in the management of tooth avulsion and also evaluate the need for further education on managing avulsed teeth.

Methods: A cross-sectional survey consisting of 18 items were filled, collected and mailed back by 121 interns of Nepal from five dental colleges. The study period was from July to September 2013. All returned questionnaires were analyzed using SPSS 17.0.

Results: Dental interns with more efficient in answering questions regarding- ideal time for replantation of an avulsed tooth ($p=0.024$), splinting period ($p=0.008$), the critical factor in the outcome of replanted tooth ($p=0.010$) and the better prognosis with open apex ($p=0.001$). Prior knowledge about management of avulsed tooth had a role in correctly answering questions on type of splint used ($p=0.022$) and better prognosis with open apex ($p=0.018$). Attending educational program on trauma management helped them in correctly answering questions on avulsed permanent tooth to be replanted ($p=0.043$) and the type of splint used ($p=0.014$).

Conclusions: Dental interns experience, prior knowledge and educational programs with dental management regarding traumatic injuries scored significantly higher than without such training or acquired information. However further knowledge needs to be enhanced by continued educational programs to ensure appropriate treatment.

Keywords: avulsion; emergency management; replantation; storage media; splinting time.

INTRODUCTION

Dental trauma is a common event during childhood and adolescence.¹ Falls, contact sports, collisions, being struck by an object and traffic accidents are the major causes of traumatic dental injuries.² Avulsed teeth represent about 16% of dental injuries.³ Avulsion is characterized by the complete displacement of the tooth out of its socket.⁴ Immediate replantation of avulsed teeth, time interval between the accident and the dental treatment and the medium in which it was kept until the dentist appointment greatly influences the outcome of replantation.^{3,5} Many avulsed teeth are lost due to lack of knowledge and proper first aid procedures.

The present study was conducted to: investigate the knowledge of Bachelor in Dental Surgery (BDS) interns in the management of tooth avulsion and to evaluate their knowledge and also the need for further education on managing avulsed teeth in Nepal.

METHODS

The cross-sectional study was conducted among the dental interns of 5 dental colleges in Nepal - Kantipur Dental College and Teaching Hospital (Kathmandu), Universal College of Medical Sciences (Bhairahawa),

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People’s Dental College and Hospital (Kathmandu), B.P. Koirala Institute of Health Sciences (Dharan) and M.B. Kedia Dental College and Teaching Hospital (Birgunj). This study was cleared and approved by the Institutional research committee of Kantipur Dental College and Research Center. The study period was from July 2013 to September 2013.

Informed consent was obtained from all the participants and strict confidentiality was assured to the participants and maintained throughout the study process. The total sample size was 121 interns (male=52, female=69) which represented all mentioned five dental colleges.

The questionnaire used was a validated modification of questionnaires used in previous studies.⁶⁻¹⁰ The questionnaire was in English language and consisted of 18 close ended questions, divided into two parts. The first part included questions on demographic and professional data including gender, age, previous experience with tooth avulsion management, received formal training or acquired knowledge on the management of avulsed teeth by attending an educational program on “management of dental trauma” and whether they could distinguish deciduous teeth from permanent teeth. The second part consisted of questions aimed at assessing the knowledge and attitude of dental interns on management of dental traumatic injuries.

All returned questionnaires were entered; cleaned, coded and analyzed using SPSS 17.0 and the Pearson’s Chi-square test was applied to assess the associations between the independent variables and knowledge related to avulsion management among the dental interns. The level of statistical significance was set at $p < 0.05$.

Description of variables- The marking scheme was tabulated. For the item 1 -10 (Table 2), 1 mark was given for a correct answer, 0 for “Do not know/Not sure” and -1 for an incorrect answer. “Do not know/Not sure” also fell in the incorrect answer when calculating the result. There were three correct answers out of four for item 5 so 1 mark was given to any of the correct answers chosen.

RESULTS

A total of 121 interns took active participation in the study and returned the completed questionnaires on the same day.

The first section included the demographic characteristics and prior exposure related to avulsion tooth for analysis. Female respondents were more 57%. More than half (57%) were above 25 years. Total 53% were in 10-12 months of internship period (Table 1). In all, 95% had

prior knowledge about management of avulsed tooth but only 36% had attended educational program regarding traumatic injuries to teeth, all participants claimed that they could distinguish primary from permanent teeth where as 55% of them had come across patients with avulsion of tooth.

Table 1. Demographic characteristics and prior exposure related to avulsion tooth.

	n (%)
Gender	
Male	52 (43.0)
Female	69 (57.0)
Age group(years)	
<25	52 (43.0)
≥25	69 (56.9)
Months of internship - Experience	
≤6	16 (13.2)
7-9	41 (33.8)
10-12	64 (52.8)
Prior knowledge about management of avulsed tooth	
Yes	115 (95.0)
No	6 (5.0)
Can differentiate primary and permanent tooth	
Yes	100 (100)
No	0 (0.0)
Attended educational programme regarding traumatic injuries to teeth	
Yes	43 (35.5)
No	78 (64.5)
Come across a patient with avulsion of tooth	
Yes	66 (54.5)
No	55 (45.5)

All of the participants knew the meaning of avulsion of the tooth. Only 7% knew that permanent tooth cannot be replanted in all cases (Table 2). More than half (55%) correctly knew that the ideal time for replantation of an avulsed tooth was 15 minutes. Almost all (99%) would rinse knocked out dirty tooth under running tap water for a few seconds without scrubbing it. Half (50%) selected patient’s saliva, 47% selected milk and 3% selected saline as the best medium to preserve the tooth before getting professional help. Eighty five percent correctly knew extra alveolar dry time as the most critical factor in the outcome of replanted tooth. In selection of splint, 46% correctly knew that flexible splint should be used. One-third (33%) knew the correct splinting period of time of 2 weeks. Only 26% responded correctly that avulsed tooth with open apex had better prognosis. Eighty six percent answered correctly that primary avulsed tooth should not be replanted.

The knowledge questions are comparatively analyzed with months of internship, prior knowledge and educational program attended and coming across an avulsed case (Table 3).

Table 2. Knowledge related questionnaire to avulsion tooth.

	n (%)
What is avulsion of tooth	
Tooth dislodgement of intact tooth out of its socket, due to any trauma †	121 (100)
Dislodgement of fractured segment of the tooth due to any trauma	0 (0.0)
Do not know	0 (0.0)
Can an avulsed permanent tooth be replanted in all cases?	
Yes	112 (92.6)
No†	9 (7.4)
What is the ideal time for the replantation of an avulsed tooth?	
15 mins†	67 (55.4)
30 mins	35 (29.0)
45 mins	8 (6.6)
1 hour	11 (9.0)
You found the knocked out tooth and it is dirty, will you	
Wipe the tooth with tissue paper	0 (0.0)
Clean the tooth with a tooth brush	0 (0.0)
Rinse the tooth gently under running tap water for a few seconds without scrubbing it†	120 (99.2)
No need to clean the tooth because it is useless	1 (0.8)
* What would be the best medium selected to preserve the tooth before getting professional care?	
Water	0 (0.0)
Saline ^{23-27†}	3 (2.5)
Patients saliva ^{25†}	61 (50.4)
Milk ^{26,27†}	57 (47.0)
What is the most critical factor in the outcome of replanted tooth?	
Extra alveolar dry time†	103 (85.1)
Splinting period	2 (1.6)
Storage media	10 (8.2)
Not sure	6 (5.0)
Type of splint used is	
Rigid	45 (37.1)
Flexible†	55 (45.5)
Anyone	6 (4.9)
Not sure	15 (12.3)
Splinting period is for	
2wks†	40 (33.0)
4wks	51 (42.1)
6 wks	14 (11.5)
Not sure	16 (13.3)
Which one has better prognosis?	
Open apex (immature tooth)†	31 (25.6)
Closed apex (mature tooth)	90 (74.4)
Should primary tooth be replanted?	
Yes	17 (14.0)
No†	104 (86.0)

*For item 5, more options could be chosen. The numbers in superscript indicate the references.

†Correct answer for the question

Table 3. Association of selected factors with knowledge related to management of avulsion tooth.

	Can an avulsed permanent tooth be replanted in all cases?		What is the ideal time for the replantation of an avulsed tooth?		Type of splint used		Splinting period is for		What is the most critical factor in the outcome of replanted tooth?		Which one has better prognosis?		Should primary tooth be replanted?														
	Correct answer	Incorrect answer	Correct answer	Incorrect answer	Correct answer	Incorrect answer	Correct answer	Incorrect answer	Correct answer	Incorrect answer	Correct answer	Incorrect answer	Correct answer	Incorrect answer													
Months of internship - Experience																											
≤6	0 (0.0)	16 (14.3)	0.441	13 (19.4)	3 (5.6)	0.024	7 (12.7)	9 (13.6)	21 (52.5)	5 (12.5)	11 (13.6)	0.008*	40 (38.8)	1 (37.8)	11 (10.7)	5 (27.8)	34 (37.8)	10 (32.3)	6 (6.7)	0.010*	10 (32.3)	6 (6.7)	0.001*	16 (15.4)	0 (0.0)	0.217	
6-9	3 (33.3)	38 (33.9)	0.420	25 (37.3)	16 (29.6)	22 (40.0)	19 (28.8)	14 (24.7)	14 (35.0)	20 (24.7)	20 (24.7)	1 (5.6)	1 (5.6)	7 (22.6)	50 (55.6)	7 (22.6)	34 (37.8)	34 (32.7)	7 (41.2)	50 (55.6)	34 (32.7)	7 (41.2)	34 (32.7)	7 (41.2)	0 (0.0)	0.106	
10-12	6 (66.7)	58 (51.8)	0.024	29 (43.3)	35 (64.8)	26 (47.3)	38 (57.6)	50 (61.7)	50 (61.7)	50 (61.7)	50 (61.7)	52 (50.5)	12 (66.7)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	14 (45.2)	0.106
Prior knowledge about management of avulsed tooth																											
Yes	9 (100)	106 (94.6)	0.476	63 (94)	52 (96.3)	0.568	55 (100)	60 (90.9)	60 (90.9)	40 (100)	75 (92.6)	0.077	98 (95.1)	17 (94.4)	4 (12.9)	88 (87.1)	88 (97.8)	27 (22.2)	27 (22.2)	88 (97.8)	27 (22.2)	88 (97.8)	27 (22.2)	98 (94.2)	17 (10)	0.310	
No	0 (0)	6 (5.4)	0.014*	4 (6)	2 (3.7)	0.014*	0 (0.0)	6 (9.1)	6 (9.1)	13 (32.5)	30 (37.0)	0.624	38 (36.9)	5 (27.8)	20 (64.5)	11 (35.5)	32 (35.6)	11 (35.5)	11 (35.5)	32 (35.6)	11 (35.5)	32 (35.6)	70 (67.3)	8 (47.1)	0 (0)	0.106	
Attended educational programme regarding traumatic injuries to teeth																											
Yes	6 (66.7)	37 (33)	0.043*	26 (38.8)	17 (31.5)	0.403	26 (47.3)	17 (25.8)	17 (25.8)	13 (32.5)	30 (37.0)	0.624	38 (36.9)	5 (27.8)	20 (64.5)	11 (35.5)	32 (35.6)	11 (35.5)	11 (35.5)	32 (35.6)	11 (35.5)	32 (35.6)	70 (67.3)	8 (47.1)	0 (0)	0.106	
No	3 (33.3)	75 (67)	0.014*	41 (61.2)	37 (68.5)	0.014*	29 (52.7)	49 (74.2)	49 (74.2)	27 (67.5)	51 (63.0)	0.631	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	13 (72.2)	0.106
Come across a patient with avulsion of tooth																											
Yes	4 (44.4)	62 (55.4)	0.776	39 (58.2)	27 (50)	0.368	35 (63.6)	31 (47.0)	31 (47.0)	21 (52.5)	45 (55.6)	0.751	58 (56.3)	8 (44.4)	16 (51.6)	15 (48.4)	51 (56.7)	15 (48.4)	15 (48.4)	51 (56.7)	15 (48.4)	51 (56.7)	46 (55.8)	8 (47.1)	0 (0)	0.504	
No	5 (55.6)	50 (44.6)	0.067	28 (41.8)	27 (50)	0.067	20 (36.4)	35 (53.0)	35 (53.0)	19 (47.5)	36 (44.4)	0.437	10 (55.6)	10 (55.6)	31 (100)	39 (43.3)	39 (43.3)	39 (43.3)	39 (43.3)	39 (43.3)	39 (43.3)	39 (43.3)	104 (100)	9 (52.9)	0 (0)	0.504	
Total	9 (100)	112 (100)	0.067	67 (100)	54 (100)	0.067	55 (100)	66 (100)	66 (100)	40 (100)	81 (100)	103 (100)	18 (100)	18 (100)	18 (100)	90 (100)	90 (100)	90 (100)	90 (100)	90 (100)	90 (100)	90 (100)	90 (100)	17 (100)	17 (100)	17 (100)	0.504

* Denotes the significance difference where the level of statistical significance was set at p<0.05.

Note: the value presented in the parenthesis is percentage

Experience level of the dental interns was based on the months of internship period and more the experience better were the respondents in answering the questions correctly. This was statistically significant in question regarding ideal time for replantation of an avulsed tooth ($p=0.024$), splinting period ($p=0.008$), the critical factor in the outcome of replanted tooth ($p=0.010$) and the better prognosis with open apex ($p=0.001$).

Respondents with prior knowledge about management of avulsed tooth were better in answering the questions correctly. This was statistically significant in questions on type of splint used ($p=0.022$) and the better prognosis with open apex ($p=0.018$).

Dental interns who had attended an educational program regarding traumatic injuries to teeth showed significant better results in answering correctly on avulsed permanent tooth to be replanted in all cases ($p=0.043$) and the type of splint used ($p=0.014$).

DISCUSSION

This study was conducted on dental interns of dental colleges of Nepal to provide baseline information about the existing level of knowledge of dental avulsion amongst them. A voluntary, self-completed, individually responded to questionnaire survey was the method used in the present study.

The result of the present study reflected that the dental interns had an average knowledge about the emergency management of avulsed teeth. There was no significant difference in the knowledge levels between the males and females. Only 36% had attended educational program. Dental health education in this field can be very effective in reducing the negative consequences of such injuries.¹¹ All participating interns knew avulsion as dislodgement of intact tooth out of its socket, due to any trauma. Research done by Adu-Dawoudet al¹² also showed 93% of the dentists knew about dental avulsion and had knowledge of emergency management of avulsed teeth.

This study found that most of the dental interns thought that all cases of avulsion of permanent tooth can be replanted. All permanent avulsed teeth cannot be replanted in all cases with extensive caries, periodontally compromised, root caries but in certain cases can be kept as temporary restoration.¹³ In permanent avulsed teeth, there is considerable risk for pulp necrosis, root resorption, and ankylosis.¹⁴

In this survey 55% knew the ideal time for replantation is within 15 minutes, which is also suggested by International Association for Dental Traumatology (IADT).¹⁵ Immediate replantation is the treatment of

choice for the cases of tooth avulsion³ or replantation following storage in a medium that maintains its vitality till dental treatment is obtained.⁴ Extra oral time should be as short as possible because damage of periodontal ligament cells begins very quickly. It is the most critical factor influencing future prognosis of a replanted tooth.¹⁶ The risk of ankylosis increases significantly with an extra oral dry time of 20 minutes.¹⁷ After the replantation, tetanus prophylaxis and systemic antibiotics should also be prescribed for the patient.¹³

For the management of avulsed dirty tooth, 99% choose to rinse the tooth gently under running tap water for a few seconds without scrubbing it. The IADT along with numerous other sources state that after an avulsion of a permanent tooth, the tooth should be handled only by the crown, gently rinsed off with water to clean away debris and re-implanted as soon as possible by anyone present at the scene.¹⁵

Half (50%) selected patient's saliva, 47% selected milk and 3% selected saline as the medium of transport to save the tooth which suggests that dental interns have adequate knowledge regarding the appropriate storage media. According to Trope¹⁸ storage medium aims to decrease the post-replantation inflammatory response, avoiding the tooth dryness and maintain the viability of the periodontal ligament cells. Saliva is found to be more effective than tap water¹⁹ and the tooth can be easily carried by the patient keeping in the buccal vestibule but saliva has a potential for bacterial contamination. Andreason favors milk as a storage medium as it maintains vitality of periodontal ligament cells up to three hours but doesn't have the ability to reconstitute cell metabolites and restore viability.²⁰ The best physiologic transportation media for avulsed teeth include (in order of preference) Viaspan™, Hank's Balanced Salt Solution (tissue culture medium) and cold milk. Next best would be a non-physiologic medium such as saliva (buccal vestibule), physiologic saline or water.^{18,20-22} Water is detrimental to cell viability due to its low osmolality and long term storage in water (i.e., more than 20 minutes) has an adverse effect on periodontal ligament healing, however it is a better choice than dry storage.²³ Pohl Y et al²⁴ showed limited tooth storage in a cell-compatible medium prior to replantation has produced similar healing results as compared with immediately replanted teeth.

The present study revealed 86% of participants responded correctly that extra alveolar dry time is the most critical factor in the outcome of replanted tooth. Tooth replantation success directly depends on the period of extra-alveolar time and on the storage medium used to keep the tooth up to replantation.¹³ The risk of ankylosis increases significantly with an extraoral

dry time of 20 minutes.²¹ An extraoral dry time of 60 minutes is considered the point where survival of the root periodontal cells is unlikely.¹⁸ Permanent teeth that are replanted immediately have the best long-term prognosis and the least incidence of necrosis, root resorption, and ankylosis.¹⁴

After replantation, an avulsed permanent tooth should be splinted where physiologic movement should be allowed of the tooth during healing. Less than half (46%) correctly answered that a flexible splint should be used which is in agreement with various studies.²⁵ Various types of acid etch bonded splints have been widely used to stabilize avulsed teeth because they allow good oral hygiene and are well tolerated by the patients. The splint should be placed on the buccal surfaces of the maxillary teeth to enable lingual access for endodontic procedures and to avoid occlusal interference.

One-third (33%) of participants in the present study responded the splinting period of 2 weeks, 42% responded for 4 weeks, 12% responded for 6 weeks. Splinting procedures do not significantly improve periodontal healing. Longer splinting times (greater than 10 days) tend to hasten the resorption process, particularly if inflexible splints are used. International Association for Dental Traumatology (IADT) suggested up to two weeks splinting for an avulsed tooth decrease the risk for ankylosis.^{13,15,17,21,26}

Teeth with incomplete/open apices replanted within 60 minutes of avulsion have higher chances of recovery by pulp revascularization. Only 26% of the respondents answered correctly. Cvek et al²⁷ reported that a teeth with open apices could promote pulp revascularization seen to occur at a rate of 18% among immature teeth. On the other hand, a mature tooth (i.e. closed apex or apical opening <1 mm) has little or no chance of revascularization. In teeth with an open apex, periodontal healing occurs more frequently than in teeth whose apex is closed.⁵ In contrast in a study by Barrett and Kenny²⁸ incisors with open apices exhibited a 4.2 times greater relative risk of failure than incisors with closed apices.

86% of dental interns responded correctly as not to replant the primary avulsed tooth. The American Academy of Pediatric Dentistry (AAPD) and the International Association for Dental Traumatology (IADT) guidelines suggest not to re-implant primary teeth because of the potential for subsequent damage to developing permanent tooth germs.^{1,15,17,23,29} Some of the risks, outlined by Zamon and Kenny³⁰ are that primary tooth can cause deflection, hypoplastic and morphologic

changes to the crown of the permanent tooth. The primary tooth may also form a dental abscess or undergo ankylosis.

CONCLUSIONS

The present study shows average knowledge in management of an avulsed tooth among dental interns of Nepal. Knowledge regarding emergency management of tooth avulsion is crucial in dentistry. Dental interns in due course of time will be placed in positions to manage patients independently therefore continuing dental education is required to ensure proper treatment to the patients presenting with such emergencies.

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REFERENCES

1. Andreasen JO, Andreasen FM. Essentials of traumatic injuries to the teeth, 2nd ed. Copenhagen, Denmark: Munksgaard; 2000. p. 7-9.
2. Glendor U. Aetiology and risk factors related to traumatic dental injuries—A review of the literature. *Dent Traumatol.* 2009;25:19-31.
3. Andreasen, J.O. and Andreasen, F.M. Text book and color atlas of traumatic injuries to the teeth. 3rd ed. Copenhagen, Denmark: Munksgaard; 1994.p. 77-149.
4. Chappuis V, Von Arx T. Replantation of 45 avulsed permanent teeth: A 1 year follow up study. *Dent Traumatol.* 2005;21(5):289-96.
5. Trope M, Chivian N, Sigurdsson A, Vann WF Jr. Traumatic injuries. In Cohen S, Burns RC, editors. *Pathways of the pulp.* 8thed. St Louis: CV Mosby; 2002.p.603-49.
6. Abu-Dawoud M, Al-Enezi B, Andersson L. Knowledge of emergency management of avulsed teeth among young physicians and dentist. *Dent Traumatol.* 2007;23:348-55.
7. Holan G, Shmueli Y. Knowledge of physicians in hospital emergency rooms in Israel on their role in cases of avulsion of permanent incisors. *Int J Paed Dent.* 2003;13:13-9.
8. Upadhyay S, Rokaya D, Upadhyaya C. Knowledge of emergency management of avulsed teeth among general dentists in Kathmandu. *Kathmandu Univ Med J.* 2012;38(2):37-40.
9. KrishnarajSubhashraj, Awareness of management of dental trauma among medical professionals in Pondicherry India. *Dental Traumatol.* 2009;25:92-4.

10. Alastair N Stokes, Heather K Anderson, Tony M Cowan, Lay and Professional Knowledge of method for emergency management of avulsed teeth. *Dental Traumatol.* 2008;24:325 –9.
11. Booth JM. "It's a knock-out"- an avulsed tooth campaign. *J Endod.* 1980;6:1-7.
12. Abu-Dawoud M, Al-Enezi B, Andersson L. Knowledge of emergency management of avulsed teeth among young physicians and dentists. *Dent Traumatol.* 2007;23:248-55.
13. Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth. 4. ed. Copenhagen: Munksgaard; 2007. p. 479-80.
14. Malmgren B, Malmgren O. Rate of infraposition of re-implanted ankylosed incisors related to age and growth in children and adolescents. *Dental Traumatol.* 2002;18(1):28-36.
15. Anderasen L, Andreasen JO, Day P, Heithersay G, Trope M, DiAngelis AJ et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dental Traumatol.* 2012;28:88–96.
16. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. Factors related to periodontal ligament healing. *Endod Dent Traumatol.* 1995;11:76-89.
17. American Academy of Pediatric Dentistry. Guideline on management of Acute Dental trauma. *Pediatr Dent.* 2011;33(2):222-8.
18. Trope M. Clinical management of the avulsed tooth: Present strategies and future directions. *Dent Traumatol.* 2002;18(1):1-11.
19. Van Hassel HJ, Oswald RJ, Harrington GW. Replantation 2: The role of periodontal ligament. *J Endod.* 1989;6:506-8.
20. Andreason JO, Andeason FM. Avulsions. In: Text book and Atlas of traumatic injuries to the teeth. 4th ed. Blackwell and Munksgaad; p.444-80.
21. Sigalas E, Regan JD, Kramer PR, Witherspoon DE, Opperman LA. Survival of human periodontal ligament cells in media proposed for transport of avulsed teeth. *Dental Traumatol.* 2004;20(1):21-8.
22. Toby Thomas, VelayuthamGopikrishna, Deivanayagam Kandaswamy. Comparative evaluation of maintenance of cell viability of experimental transport media "coconut water" with Hank's balanced salt solution and milk, for transportation of an avulsed tooth: An in vitro cell culture study. *J Conserv Dent.* 2008;11:22-9.
23. Andreasen JO, Andreasen FM. Textbook and Color Atlas of Traumatic Injuries to the teeth. 4thed, Munksgaard; 2007.p.897.
24. Pohl Y, Filippi A, Kirschner H. Results after replantation of avulsed permanent teeth. II. Periodontal healing and the role of physiologic storage and antiresorptive-regenerative therapy. *Dental Traumatol.* 2005;21(2):93-101.
25. Yanxiang Zhao, Yi Gong. Knowledge of emergency management of avulsed teeth: A survey of dentists in Beijing, China. *Dent Traumatol.* 2010; 26:281-4.
26. Flores MT, Andersson L, Andreasen JO et al. Guidelines for the management of traumatic dental injuries. II. Avulsion of permanent teeth. *Dental Traumatol.* 2007; 23(3):130-6.
27. Cvek M, Cleaton-Jones P, Austin J, Lownie J, Kling M, Fatti P. Pulp revascularization in reimplanted immature monkey incisors – Predictability and the effect of antibiotic systemic prophylaxis. *Endod Dent Traumatol.* 1990;6(4):157-69.
28. Barrett EJ, Kenny DJ. Survival of avulsed permanent maxillary incisors in children following delayed replantation. *Endodontics and Dental Traumatol.* 1997;13:19-23.
29. Flores MT, Malmgren B, Andersson L, et al. Guidelines for the management of traumatic dental injuries.III. Primary teeth. *Dental Traumatol.* 2007;23(4):196-202.
30. Zamon E, Kenny D. Replantation of Avulsed Primary Incisors: A Risk-Benefit Assessment. *J Can Dent Assoc.* 2001;67:386-391.