



# Assessment of dentists' knowledge in rabat concerning the management of dental avulsion

## Evaluation des connaissances des dentistes à rabat concernant la gestion d'expulsion dentaire

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### ABSTRACT

**Background :** Dental avulsion is an emergency whose prognosis depends on the promptness of the treatment. Adequate management requires the acquisition of correct knowledge, attitude and practice, thus the prognosis of the avulsed tooth should be improved, both in the short and in the long term.

**Aim :** This study was carried out in order to assess the level of knowledge, attitude and practice of dentists working in the city of Rabat, Morocco regarding their management of avulsed teeth and the factors associated with this level.

**Methods :** A 14-item questionnaire regarding dental avulsion and its management was administered to dentists working in private practice in Rabat using convenience-sampling methodology. The data obtained were entered into Statistical Package for the Social Sciences database (IBM, SPSS version 13.0, Chicago, USA) and analysed with a significance level established at  $p < 0.05$ . The knowledge, attitude and practice level was assessed using a scoring system. Chi2 and Fisher's Exact tests were used to compare the groups.

**Results :** A total of 205 dentists, representing 37% of all dentists working in the private sector in Rabat, completed the questionnaires. The level of knowledge, attitudes and practices of the dentists in this study was moderate with an overall median score of 5 [4;6]. Most of the participants answered the knowledge-based questions correctly, except for those concerning the extra-alveolar period, the timing of endodontic treatment, and the type and duration of retention.

**Conclusion :** Given the lack of other studies concerning Moroccan dentists, comparison with studies carried out in other countries is difficult, hence the need to carry out more Moroccan studies in order to improve this level.

**Key words:** mature permanent tooth – avulsion – management – knowledge – attitude – practice.

### RÉSUMÉ

**Introduction :** L'avulsion est une urgence dont le pronostic dépend de la rapidité du traitement. Une prise en charge adéquate nécessite l'acquisition de connaissances, d'attitudes et de pratiques correctes afin d'améliorer le pronostic de la dent avulsée, tant à court qu'à long terme.

**But :** Cette étude a été réalisée afin d'évaluer le niveau de connaissance, l'attitude et la pratique des dentistes travaillant dans la ville de Rabat, au Maroc, concernant leur gestion des dents avulsées et les facteurs associés à ce niveau.

**Méthodes:** Un questionnaire de 14 items concernant l'avulsion dentaire et sa prise en charge a été administré aux dentistes exerçant en cabinet privé à Rabat en utilisant une méthodologie d'échantillonnage de convenance. Les données obtenues ont été saisies dans la base de données Statistical Package for the Social Sciences (IBM, SPSS version 13.0, Chicago, USA) et analysées avec un niveau de signification établi à  $p < 0,05$ . Le niveau de connaissances, d'attitudes et de pratiques a été évalué à l'aide d'un système de notation. Les tests du Chi2 et du Fisher's Exact ont été utilisés pour comparer les groupes.

**Résultats :** Un total de 205 dentistes, représentant 37 % de tous les dentistes travaillant dans le secteur privé à Rabat, ont rempli les questionnaires. Le niveau des connaissances, d'attitudes et de pratiques des dentistes de cette étude était modéré avec un score médian global était de 5 [4;6]. La plupart des participants ont répondu correctement aux questions basées sur les connaissances, sauf celles concernant la période extra-alvéolaire, le moment du traitement endodontique, le type et la durée de la contention.

**Conclusion :** Etant donné le manque d'autres études concernant les dentistes marocains, la comparaison avec des études réalisées dans d'autres pays est difficile, d'où la nécessité de réaliser davantage d'études marocaines afin d'améliorer ce niveau.

**Mots clés :** dent permanente mature - avulsion - gestion - connaissance - attitude - pratique.

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## INTRODUCTION

Avulsion is a trauma during which the tooth is completely moved out of its socket (1). Its prevalence among other traumas varies according to the studies from 0.5 to 3%, 6% or even up to 16% (2). According to the current guidelines of the International Association of Dental Trauma (IADT), established in 2012 (3) and recently updated in 2020 (4), the management of an avulsed permanent tooth is replantation whenever possible. Healing then depends on the stage of root development, the complications caused to the periodontal ligament, the management of bacterial infection and the promptness of management (5-8). Thus, the prognosis is related, among other things, to the time factor (9). Several studies have shown that a favourable prognosis of a replanted avulsed tooth is associated with immediate replantation (at the site of accident), or when the avulsed tooth is adequately preserved for an extra-oral time of less than 15 minutes, or strictly less than 60 minutes (10) or well preserved on appropriate storage medium. In the absence of these conditions, the prognosis would be affected. During bibliographic research, no study that reported the knowledge of dentists in Morocco regarding the management of avulsed mature permanent tooth was found. This study was carried out in order to assess the level of knowledge, attitude and practice of dentists working in the city of Rabat, Morocco regarding their management of avulsed teeth and the factors associated with this level.e.

## METHODS

The ethics committee approved the current study. Each subject (according to the ethical principles of the World Medical Association Declaration) provided informed written consent. A 14-item questionnaire was developed using a cross-sectional survey design and pre-tested online with a group of thirty dentists. Difficulties were identified in respondents' understanding of the questionnaire and the necessary modifications were made based on these results. The final questionnaire consisted of demographic items and multiple-choice questions regarding dental avulsion and its management. The survey was administered to dentists working in private dental offices in the various sectors of the city of Rabat, Morocco.

According to the statistics in Morocco, the total number of dentists working in the private sector in Rabat in 2014 is 554. They were contacted to request their participation in this study over a period of four months starting in February 2019 using convenience-sampling methodology. Dentists who were willing to participate were asked to read an information note explaining the objectives of the study and to sign an informed consent form before completing the anonymous questionnaire distributed directly to dental offices. No personal information on the dentists' identities was required to be disclosed. The data obtained from the survey were manually entered into Statistical Package for the Social Sciences database (IBM, SPSS version 13.0, Chicago, USA) and analysed with a significance level established at  $p < 0.05$ .

Quantitative variables with a symmetric distribution were expressed as mean and standard deviation, while those with a asymmetric distribution were expressed as median and quartiles.

Qualitative variables were expressed as numbers and percentages.

According to the IADT guidelines [3], the nine parameters analysed were:

- Treatment choice: "replantation when it's possible" was considered the correct answer.
- Optimal extra-alveolar time: answers with "time equal or less than 30 minutes and equal or less than 60 minutes" were considered as correct.
- Physiologic storage medium: "HBSS (Hank's Balanced Salt Solution)" or "milk" were considered correct answers (if we respect the corresponded allowed time : a maximum of 2h for the milk and 24 h for HSB)
- Endodontic treatment for permanent mature tooth: "completion of endodontic treatment in all cases" was the correct.
- Time of endodontic treatment: "initiation of root canal treatment 7 -10 days after replantation" was the correct answer.
- Type of splinting : "Flexible splints" was the correct answer.
- Splinting period: "2 weeks" was the correct answer.
- Systemic medication: "Prescribe antibiotics, anti-inflammatory drugs and tetanus prevention" was the correct answer.
- Follow-up: "1 month, 3, 6, 12 months then once a year for 5 years" was the correct answer.

The respondents' level of knowledge, attitude and practice regarding tooth avulsion and its management was assessed using a scoring system that corresponds to the sum of the correct knowledge, attitudes and practices (correct KAP) and that assigned one point for each correct answer and zero point for a wrong answer, with a maximum possible score of nine points (nine parameters analysed).

The respondents were divided into three groups according to the points:

- 0 to 3 points : group with a low level of KAP.
- 4 to 6 points : group with a moderate level of KAP.
- 7 to 9 points : group with a high level of KAP.

Chi-Square and Fisher's Exact tests were used to analysis the association between the groups of levels KAP and the demographic factors. The univariate analysis was performed with a 95% confidence interval.

## RESULTS

A total of 205 dentists, representing 37 % of all dentists working in the private sector in Rabat completed the questionnaires with data that were suitable for statistical analysis.

The median age of the included dentists was 36 [30; 45] years. The number of female participants 115(56.1%). The demographic characteristics of the study population are shown in Table 1. The percentage distribution of the answers to the questions regarding avulsion and its management is shown in Table 2.

**Table 1.** Demographic characteristics of the study population.

Variables	Total N=205, n (%)
<b>Age</b>	
≤ 35 years	97 (47,3)
36-45 years	63 (30,7)
≥ 46 years	45 (22)
<b>Sex</b>	
Male	90 (43,9)
Female	115 (56,1)
<b>Type of practice</b>	
General Practitioners	151 (73,7)
Orthodontists	33 (16,1)
Periodontists	15 (7,3)
Pedodontists	6 (2,9)
<b>Years of experience</b>	
≤ 10 years	112 (54,6)
11-20 years	52 (25,4)
≥ 21 years	41 (20)
<b>Reception or not of cases of dental avulsion</b>	
Yes	130 (63,4)
No	75 (36,6)

**Table 2.** Distribution of the responses to questions about avulsion and its management.

Questions about the management of avulsed permanent mature tooth	n (%)
<b>Treatment choice</b>	
Correct	194(94,6)
Incorrect	11(5,4)
<b>Optimal Extra-Alveolar Time</b>	
Correct	101(49,3)
Incorrect	104(50,7)
<b>Physiologic storage medium</b>	
Correct	131(63,9)
Incorrect	74(36,1)
<b>Endodontic treatment</b>	
Correct	108(52,7)
Incorrect	97(47,3)
<b>Time of Endodontic treatment</b>	
Correct	53(25,9)
Incorrect	152(74,1)
<b>Type of splinting</b>	
Correct	84(41)
Incorrect	121(59)
<b>Splinting period</b>	
Correct	44(22)
Incorrect	161(78)
<b>Systemic medication</b>	
Correct	23(11,2)
Incorrect	182(88,8)
<b>Follow-up</b>	
Correct	128(62,4)
Incorrect	77(37,6)

The overall median score was 5[4 ;6], which means a moderate level of correct KAP according to this study. The univariate analysis (Table 3) showed that age, sex, type of practice and years of experience were significantly associated to this KAP level.

**Table 3.** Level of correct KAP according to demographic variables

Demographic variables	Levels of correct KAP			p
	Low level	Moderate level	High level	
<b>Age</b>				<b>&lt;0,001</b>
≤ 35 years	3	81	13	
36-45 years	25	34	4	
≥ 46 years	4	36	5	
<b>Sex</b>				<b>0,008</b>
Male	17	70	3	
Female	15	81	19	
<b>Type of practice</b>				<b>0,002</b>
General Practitioners	29	109	13	
Orthodontists	0	28	5	
Periodontists	3	8	4	
Pedodontists	0	0	0	
<b>Years of experience</b>				<b>&lt;0,001</b>
≤ 10 years	6	92	14	
11-20 years	22	27	3	
≥ 21 years	4	32	5	
Reception or not of cases of dental avulsion				0,8
Yes	19	97	14	
No	13	54	8	

## DISCUSSION

The aim of the present study was to assess Moroccan dentists' knowledge, attitude and practice concerning the emergency management and clinical treatment of avulsed permanent teeth.

### The level of KAP

The level of knowledge, attitude and practice of the surveyed sample of dentists was found to be moderate, with an overall median correct KAP score of 5[4 ;6]. In the univariate analysis, the factors associated significantly with this overall median of correct KAP were the age, the sex, the type of practice and the years of experience, whereas reception or not of cases of tooth avulsion had no significant effect (Table 3).

These results could be explained by the fact that the highest level of correct KAP score was significantly observed in participants whose age 35 years or less was ( $p<0.001$ ), so, younger dentists having easier access to academic websites for research such as the IADT used in this study, than older dentists. Similarly, a significantly higher level of correct KAP score was observed for practitioners with up to 10 years of experience compared to other groups ( $p<0.001$ ). This could

be explained by the fact that the group of dentists with the least number of years of experience are recently graduated, reflecting a recent acquisition of information. This association was statistically significant ( $p < 0.001$ ), and it was similar to Duruk et al's study (22). These findings were not consistent with the results obtained in other studies (15,19,20), in which it was confirmed that as the number of years of clinical practice increases, dentists' knowledge of tooth avulsion management improves (23), and most of which have shown a low level of knowledge regarding this subject (12-22).

Concerning the sex, the highest level of correct KAP score was observed in female participants. This could be explained by the fact that the number of women included in the study is larger than that of men. The same explanation could be given for the type of practice, as the highest level of KAPs was found in the general practitioner category, which could be due to the larger number of general practitioners included in this study compared to the other categories.

The treatment choice of avulsed permanent mature tooth Replantation when it is possible was suggested by 194(94,6%) of the participants. This observation was in correlation to IADT guidelines (3-5). Indeed, Replantation of the tooth as soon as possible (while still at the accident site) is the treatment of choice, but when it is difficult to achieve for the accident victim or the person in charge, a dental consultation must be made urgently (3-5). In cases of severe caries, periodontal disease, and medical conditions, such as immunosuppression or severe cardiac diseases, or in cases in which the patient is not conscious or not cooperative, replantation of the avulsed permanent tooth is not indicated according to the IADT guidelines (3-5).

#### **The extra-oral time**

The ideal extra-oral time reported by 104(50,7%) of the dentists surveyed was more than 60 min, what is not consistent with the IADT guidelines (3-5). These results demonstrated that Moroccan dentists had poor knowledge regarding the ideal extra-oral time for avulsed teeth. In fact, the longer the time interval between tooth avulsion and its replantation, the greater the risk of replacement resorption and inflammatory root resorption [8, 9]. Treatment guidelines state that if the extra-oral dry time of a tooth exceeds 60min, all periodontal ligament cells become non-viable (8,9). According to Andreason (8), teeth that are replanted within 30 minutes have a better success rate than those that were extra oral for longer periods of time before replantation.

#### **The storage medium**

If immediate replantation cannot be performed, a suitable storage medium should be used. Concerning this parameter, the majority of the respondents 131(63,9%) indicated properly that the avulsed tooth should be kept in HBSS or milk while 74(36,1%) of the respondents chose saline solution or saliva as the transport medium.

Trope (10) suggested that the storage medium for avulsed tooth (in order of preference) included Hank's Balanced Salt

Solution (HBSS), milk, saline, and saliva (buccal vestibule). HBSS is a standard saline solution that is widely used in biomedical research to support the growth of many cell types, although it is not yet available in pharmacies or drugstores around the world (17). It can be used as a conservation medium for avulsed teeth for a period of 24 h. Milk is regarded as a convenient storage medium for an avulsed tooth because it is easy to obtain in the event of an accident and it can maintain periodontal ligament (PDL) cells thanks to its osmolality that is 232 mosm/l (25,26). Storage of the avulsed tooth in milk at room temperature has been reported to preserve the viability of PDL cells for up to 60 min, whereas refrigerated milk preserves viability for an additional 45 min (25,26). Saliva should only be indicated when neither milk nor saline solution are available. Andreassen et al. (27) clarified that when saliva is used as a storage medium, the extra-oral time must be limited to a maximum of two hours, due to the hypotonic nature of the medium (the osmolality of saliva is 60-80 mosm/l much less than the normal range (230-400 mosm/l) required for cell growth), and the fact that bacteria present in saliva may have a negative effect on later healing (27). Saline has been shown to be a short-term storage media because of its physiologic osmolality. It was found that the avulsed teeth that were soaked in saline solution for 30 minutes before replantation showed less root resorption than those stored dry for 15-40 minutes (28). Water is the least desirable storage medium because the hypotonic environment causes rapid cell lysis and increased inflammation on replantation (29).

#### **Splinting**

After replantation, splinting is highly recommended. In the current study, the result was quite unsatisfactory, as 121(59%) of the respondents stated they would use a rigid splint and 161(78%) of the participants recommended a splinting period for more than four weeks what is not consistent with the IADT guidelines. Again, the results demonstrated that Moroccan dentists had low level knowledge, attitude and practice regarding the type and period of splinting for avulsed teeth. The use of a flexible splint is recommended for 7-14 days (3,30). In fact, this period is sufficient for achieving periodontal support in order to maintain the avulsed tooth in position, except in cases of extra-oral time more than 60 minutes or tooth avulsion associated with alveolar fracture, when splinting must be maintained for a period of 4 weeks or 4-8 weeks respectively (30).

#### **Endodontic treatment**

As recommended by the IADT, root canal treatment for a tooth with a closed apex should be performed in all cases. That was stated by 108(52,7%) of the respondents, while about 152(74,1%) of them would perform it only when signs of necrosis appear what is not consistent with the IADT guidelines (3), that suggested to initiate the root canal treatment 7-10 days after replantation of avulsed permanent mature tooth, to control infection and therefore prevent inflammatory root resorption.

### Drug prescription

In the current study, the majority of dentists 152(74.1%) favoured prescribing broad-spectrum antibiotic therapy after replantation while only 23(11.2 %) of them suggested prescribing antibiotics, anti-inflammatory drugs and employing tetanus prevention strategies. The American Association of Endodontists (AAE) (11) and the IADT (3) have recommended systemic antibiotics, such as penicillin V four times a day or doxycycline two times a day for seven days, at doses depending on the patient's age and weight. Furthermore, experimental animal studies [30] have also verified a reduction in root resorption with the use of systemic antibiotics following replantation of teeth. In fact, there is no evidence on preferred antibiotic and dosage after replantation of avulsed teeth (30). Hence, further studies are recommended to determine the choice of drug for replantation of avulsed teeth. The IADT (3) recommends also referring the patient to a physician to evaluate the need for a tetanus booster in cases in which the avulsed tooth has contacted soil or the tetanus coverage is uncertain.

### Follow-up

The most of participants in this study 128(62.4%) were aware and reported that they would establish a follow-up after 2, 4 weeks, 3 months, 6 months, 1 year and then yearly for 5 years, which are in line with the IADT guidelines. Monitoring replanted teeth by means of clinical and radiographic exams must be performed for a minimum period of five years, aimed at verifying possible treatment complications, such as inflammatory resorption, resorption by substitution, ankylosis and teeth in infraocclusion (1,3,10-11).

### Study limitations

A major limitation of this study is the sampling methodology. A convenience sample was adopted in this study for practical reasons of accessibility and time limitation. A convenience sample may not sufficiently represent the entire population of dentists working in Rabat.

Another limitation is the method of administering the questionnaire, where an interview with the dentists to explain the questions was not possible, which may cause a bias of understanding. In addition, a direct comparison of the results with those of other studies was not always possible due to differences in the questions and answers choices.

However, strength of the study is that it is the first one to evaluate the level of knowledge about management of avulsed teeth among Moroccan dentists.

## CONCLUSION

Within the limitations of this study, the overall level of Moroccan dentists' knowledge about the management of avulsed permanent mature teeth was moderate. The present findings highlight the need for further education on traumatic dental injuries.

Studies conducted in others countries, such as Turkey (12,22), Iran (14), Italy (13), Saudi Arabia (15,19), Malaysia (18), India (21) and Brazil (17), concluded that there is a need to improve the knowledge of dentists in the current guidelines for emergency treatment of avulsed teeth.

More studies using clinical scenario-based questions related to permanent tooth avulsion and its management should be carried out and dental practitioners should use all means available to improve their knowledge, attitude and practice of the treatment of avulsed tooth.

## REFERENCES

1. Andreasen JO, Andreasen FM, Andersson L, editors. Textbook and Color Atlas of Traumatic Injuries to the Teeth. Wiley-Blackwell: John Wiley & Sons; 2013. p. 383-425.
2. Andersson L. Epidemiology of traumatic dental injuries. J Endod 2013;39:S2-5.
3. Andersson 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. Dent Traumatol. 2012; 28: 88-96.
4. Fouad AF, Abbott PV, Tsilingaridis G, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent traumatol. 2020;36:331-342. <https://doi.org/10.1111/edt.12573>
5. Andersson L, Andreasen JO, Day P, Heithersay G, Trope M. Guidelines for the Management of Traumatic Dental Injuries: 2. Avulsion of Permanent Teeth. Pediatr Dent. 2017; 39(6):412-419
6. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 1. Diagnosis of healing complications. Dent Traumatol. 1995;11(2):51-8.
7. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal ligament healing. Endod Dent Traumatol 1995; 11:76-89.
8. Andersson L, Bodin I. Avulsed human teeth replanted within 15 minutes – a long-term clinical follow-up study. Endod Dent Traumatol 1990; 6: 37-42.
9. Andreasen JO. Effect of extra-alveolar period and storage media upon periodontal and pulpal healing after replantation of mature permanent incisors in monkeys. Int J Oral Surg. 1981 ; 10 :43-53.
10. Trope M. Avulsion of permanent teeth: Theory to practice. Dent Traumatol 2011;27:281-94.
11. American Association of Endodontists. Recommended guidelines of the AAE for the treatment of traumatic dental injuries. 2013. <http://www.aae.org/guidelines/>.
12. Cinar C, Atabek D, Alaçam A. Knowledge of dentists in the management of traumatic dental injuries in Ankara, Turkey. Oral Health Prev Dent 2013;11: 23-30.
13. Re D, Augusti D, Paglia G, Augusti G, Cotti E. Treatment of traumatic dental injuries: evaluation of knowledge among Italian dentists. Eur J Paediatr Dent. 2014; 15: 23-8.
14. Akhlaghi N, Nourbakhsh N, Khademi A, Karimi L. General dental practitioners' knowledge about the emergency management of dental trauma. Iran Endod J 2014; 9: 251-6.

15. AlJazairy YH, Halawany HS, AIMaflehi N, Alhussainan NS, Abraham NB, Jacob V. Knowledge about permanent tooth avulsion and its management among dentists in Riyadh, Saudi Arabia. *BMC Oral Health*. 2015; 15: 135.
16. Al-Zubair NM. General dentists knowledge about the emergency management of dental avulsion in Yemen. *Saudi J Oral Sci*. 2015; 2: 25.
17. Menezesa MC, Carvalhob RG, Accorsi-Mendonçab T, De-Deus G, Moreirad EJ, Silva EJ. Knowledge of dentists on the management of tooth avulsion injuries in Rio de Janeiro, Brazil. *Oral Health Prev Dent*. 2015; 13: 457-60.
18. Abdullah D, Soo SY, Kanagasingam S. Knowledge of managing avulsed tooth among general dental practitioners in Malaysia. *Singapore Dent J*. 2016; 37: 21-6.
19. Alaslami RA, Elshamy FMM, Maamar EM, Ghazwani YH. Awareness about Management of Tooth Avulsion among Dentists in Jazan, Saudi Arabia. *Open Access Maced J Med Sci*. 2018 ; 6(9):1712-1715.
20. Zafar K, Ghafoor R, Khan FR, Hameed MH. Awareness of dentists regarding immediate management of dental avulsion: Knowledge, Attitude, and Practice study. *J Pak Med Assoc* 2019; 68(4) : 595-599.
21. Kariya PB, Singh S, Bargale S, Shah S, Kulkarni N, Dave BH. Evaluation of knowledge regarding emergency management of avulsed traumatic dental injuries in children among general dental practitioners in India. *Indian J Dent Res*. 2019 ; 30 : 21-6
22. Duruk G, Erel ZB. Assessment of Turkish dentists' knowledge about managing avulsed teeth. *Dent Traumatol*. 2020 Jan 10. doi: 10.1111/edt.12543.
23. Kenny KP, Day PF, Douglas GVA, Chadwick BL. Primary care dentists' experience of treating avulsed permanent teeth. *British Dental Journal* 2015; 219: E4.
24. Adnan S, Lone MM, Khan FR, Hussain SM, Nagi SE. Which is the most recommended medium for the storage and transport of avulsed teeth? A systematic review. *Dent Traumatol*. 2018; 34(2):59-70.
25. de Souza BD, Bortoluzzi EA, Reyes-Carmona J, Dos Santos LG, Simões CM, Felipe WT, Felipe MC. Effect of temperature and seven storage media on human periodontal ligament fibroblast viability. *Dent Traumatol*. 2017; 33(2):100-105.
26. Chen F, Qi S, Lu L, Xu Y. Effect of storage temperature on the viability of human periodontal ligament fibroblasts. *Dent Traumatol*. 2015 ; 31(1):24-8.
27. Andreasen JO, Andreasen FM. Essentials of traumatic injuries to the teeth, 1st edn. Copenhagen: Munksgaard; 1994. 113–31 pp.
28. Blomlöf L, Otteskog P, Hammarström L. Effect of storage in media with different ion strengths and osmolalities on human periodontal ligament cells. *Euro J Oral Sci*. 1981; 89(2):180-187.
29. Blomlöf L. Milk and saliva as possible storage media for traumatically exarticulated teeth prior to replantation. *Swed Dent J Suppl* 1981;8:1.
30. Ben-Hassan MW, Andersson L, Lucas PW. Stiffness characteristics of splints for fixation of traumatized teeth. *Dental Traumatology* 2016 ; 32:140-145.