Dental Traumatology

Dental Traumatology 2010; **26**: 223–227; doi: 10.1111/j.1600-9657.2010.00873.x

Teledental consultations related to trauma in a Swiss telemedical center: a retrospective survey

Nicolas Lienert[1], Nicola Ursula Zitzmann[1], Andreas Filippi[2], Roland Weiger[1], Gabriel Krastl[1]

[1]Center of Dental Traumatology and Department of Periodontology, Endodontology and Cariology, University of Basle, Basle, Switzerland; [2]Center of Dental Traumatology and Department of Oral Surgery, Oral Radiology and Oral Medicine, University of Basle, Basle, Switzerland

Correspondence to: Gabriel Krastl, Department of Periodontology, Endodontology and Cariology, Hebelstrasse 3 Basel 4056, Switzerland University of Basle, Basle, Switzerland
E-mail: gabriel.krastl@unibas.ch

Accepted 2 January 2010

Abstract – *Background/Aim*: In addition to medical advice, telemedical centers also provide counseling on the telephone for patients with dental injuries. *Material and Methods*: Data from a Swiss telemedical center during the years 2001–2008 were analyzed retrospectively. *Results*: A total of 371 988 medical consultations were recorded. Of these, 3430 concerned dental problems, with 672 reports about dental trauma following accidents with 772 injuries. The patients average age was 8.6 years (range 0–73 years). About two-thirds of the cases belonged to the age group 0–6 years, and one-third to the group of 7–80 years. The reasons for calling were dislocations (53%), fractures (31.9%), and avulsions (7.9%). In 76.2% of the cases, the center was contacted on the day of the accident. The majority of the patients (60%) contacted the telemedical center during the so-called 'out of office hours' (Monday to Friday 6 pm to 8 am, and Saturday/Sunday all day). *Conclusions*: Telemedicial services can be helpful for cases related to dental trauma and may provide valuable support when a dentist is not available.

Traumatic dental injuries are very common and frequently present an emergency situation with considerable burden on the patient. The number of oral injuries tends to be higher during weekends and in the late evenings than at any other times (1). In some cases the prognosis may depend on immediate and appropriate intervention. However, a dental emergency service is not available on a 24-h basis in every geographic region and any significant delay in taking adequate measures may impair the outcome (2).

Hence, emergency management often depends on whoever happens to be present at the site of the accident. However, surveys have revealed generally poor knowledge among laypeople about the appropriate behavior in case of dental trauma (3).

There is clearly a need for educational campaigns among the public to improve emergency management after oral trauma. In addition, providing medical advice from telemedical centers seems like a promising alternative as a way of obtaining further assistance in case of an emergency. Such a service has not, however, yet been described in the literature.

Telemedicine is defined by the International Society for Telemedicine and E-Health (ISfTeH) as the 'delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communications technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interest of advancing the health of individuals and their communities'(4).

It is already common practice for patients to seek medical advice from their physicians by telephone. In recent years, specialized telemedical centers have emerged as important partners in health care in response to patients' requirements. They are also the result of increasing pressure on general practitioners (GP) and Accident and Emergency (A&E) departments, particularly in the National Health Service (NHS) in the United Kingdom (5, 6). NHS Direct is a 24-h telephone advice system staffed by medical and dental nursing personnel, which aims to help callers to manage problems at home and reduce unnecessary demands on other NHS services.

In various other settings, specialized telemedical centers have also developed into important partners in health care. The core competence of a telemedical center is an efficient medical triage, allowing better allocation of resources with shorter medical-diagnostic pathways (7–9). Telephone consultations also appear to be safe. Moreover, the majority of patients said they were just as satisfied using the telephone as going to see someone face-to-face (5). In dentistry, telemedical consultations do not yet seem to be well known. To find out how widespread such consultations are in dentistry, a literature search was conducted in PubMed using the term 'teledentistry'. Additionally, the personal database of one of the authors (N.L.), comprising articles and references related to the topic was explored and a total

of 37 articles were retrieved. The reference lists of the relevant articles were also examined for pertinent literature, but no further articles were found. Several prospective studies have investigated the quality of telemedical consultations in orthodontics, oral pathology, and oral radiology based on the 'store-and-forward' approach (10–14) or using real-time videoconferencing (15). Four studies assessed the demand among general dental practitioners for telemedical services (16–19).

The other articles described different approaches to teledental patient care, or the development and potential future of teledentistry (19–31). None of the articles, however, focused on a telephone triage of physicians who give advice to patients with dental problems.

The purpose of this study was to assess the occurrence of phone calls related to dental trauma in a major telemedical center in Switzerland and to collect information regarding patient profiles, geographic region, time of calling, and assumed type of injury.

Material and methods

Telephone consultations at Medgate

Several large health insurance companies in Switzerland offer their customers services provided by the Swiss Center for Telemedicine Medgate in Basle without charge. Patients enrolled in this service through their healthcare insurance may consult Medgate's medical professionals at any time. Additionally, these services can be used by individual and company members. Hence, about one-third (2 407 574 persons/31.7%) of the entire Swiss population (7 593 494 inhabitants) (32) are entitled to use Medgate's medical services free of charge. Of these, about 3% (80 371) used telephone triage services in 2007 for medical advice. From 2001 to 2008, Medgate's medical personnel provided over 370 000 phone consultations, covering inquiries related to general medicine or determining a medical triage. From the beginning, dental advice was part of the services rendered, although it was never explicitly advertised. As could be expected, a large percentage of dental inquiries concerned traumatic dental injuries.

The Swiss Center for Telemedicine Medgate employs medical doctors trained in telemedicine, who are available 24×7. For each call, the reason for calling and a full medical history are collected as soon as a medical condition is suspected. The information obtained is documented electronically and a diagnosis formulated. This preliminary diagnosis is then discussed with the patient and further measures are proposed.

To assess the incidence of dental accidents in the years under investigation, all triage cases were extracted from the data records of Medgate patients by categorizing the keywords according to the field 'dental medicine' and to the German terms related to 'tooth' or 'dental'.

The exact time of calling and the personal data of the patients (age, gender, place of residence) were documented for every patient. Patient data were used in an anonymous format in this study. The anamnestic data of the patients, the diagnosis given, and the recommendations for further action as well as the acuteness of the possible treatment were extracted from the medical data records. All cases related to dental medicine were identified and categorized according to their hypothetical diagnosis, but only the dental accidents were selected for this study. These were categorized into groups according to the type of injury: avulsion, fracture, or dislocation. In most cases, the diagnosis was easily deduced from the anamnestic data according to the patients' and/or callers' descriptions, for example, when teeth were fractured or entirely lost (avulsed). Apart from fractures in already restored teeth, all types of fractures were subsumed under the term 'fractures'. Dislocations were not divided into subgroups as the data records were not specific enough. Concussions, lateral dislocations, intrusions, and extrusions (without avulsions) were summarized under the term 'dislocations'. To compare deciduous and permanent types of dentition, at least in part, the patients were classified as belonging to either the 0- to 6- or the 7- to 80-year-old group, with subgroups 7–19 and 20–80 years to compare adolescents with adults. Multiple injuries in one patient were included in the overall count and each injury was assigned to the respective injury type. Multiple injuries in one tooth were not found in the database. This may be due to the fact that callers only reported the more severe injury type (e.g. the avulsion, and not a potentially concomitant tooth fracture). Furthermore, from the user-defined text field reserved for anamnesis, the time delay between accident and time of the call was determined and classified into three groups, namely: 'accident today', 'accident 1 to 7 days ago' and 'accident longer than 7 days ago'.

Depending on the individual diagnosis, the medical doctors at the telemedical center recommended visiting a doctor/dentist within different time. These were categorized into five different groups: immediate consultation (within hours), or consultation within 24, 48 h, after more than 2 days, or, alternatively, only self-help was recommended. In 2007, additional data about the regional distribution of the caller were collected and categorized as urban (including suburban areas) or rural.

To describe associations between nominal variables, cross tables were calculated and Fisher's exact test was performed. Odds ratios (OR) with corresponding 95% confidence intervals were estimated. To compare two proportions, a test for equality of two proportions was used. A 95% confidence interval of the difference of the proportions was also calculated. $P < 0.05$ was considered as significant. All analyses were carried out using 'R' (version 2.7.1, R Development Core Team (2005). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org.)

Results

From 2001 to 2008, Medgate provided a total of 371 988 telephone triage services. During this period, 3430 patients (0.92%) received counseling on dental problems, of whom 672 (19.6%) called because of dental accidents: 383 males (57%), 289 females (43%). The average age was 8.6 years (range 0–73 years). The cases were classified according to dentition, with 429 (63.8%) belonging to the 0-6 years age

group, 172 (25.6%) to the 7–19 years age group and 71 (10.6%) to the 20- to 80-years age group (Fig. 1). Five hundred ninety patients (87.8%) were under 20-years old.

Of the 772 injuries, 61 (7.9%) were avulsions, 246 (31.9%) were fractures, 409 (53.0%) were dislocations, 27 (3.5%) presented fractures on previously damaged teeth, and 22 (2.9%) injuries were limited to the oral soft tissues. In seven cases (0.9%), a dental accident was clearly involved, but no diagnosis could be given on the basis of the anamnestic data because the records were not specific enough. In the age group 0–6 years, a total of 484 dental trauma were recorded, with approximately two thirds (324, 66.9%) being dislocations, almost a quarter (115, 23.8%) fractures, and a tenth (45, 9.3%) avulsions.

In the age group 7–80 years, more than half of the accidents were diagnosed as fractures (131, 56.5%), 36.6% (85) as dislocations, and 6.9% (16) as avulsions.

Dislocation injuries (tooth dislocation and avulsions) were significantly ($P = 0.001$) more frequent in the 0–6 years age group (76.6%) than in the 7–80 years age group (23.4%) (Fig. 2).

All fractures in the 0–6 years age group and in the 7–19 years age group (101) were caused by direct trauma, while those in the 20–80 years age group occurred mostly in previously damaged teeth. Nineteen of the injuries limited to the oral soft tissues occurred in the age group 0–6 years, while only three cases were observed in the age group 7–80 years.

In the majority of the cases (512, 76.2%), the consulting center was contacted on the day of the accident, in 17.3% (116) within the first week, and in 6.5% (44) after 1 week had already passed. Among the patients who called more than 1 week after the accident, 23 (52.3%) mentioned discoloration of an injured tooth as the main reason for calling. Of these, most (22) occurred in the primary dentition.

During the so-called 'out of office hours' (Monday to Friday 6 pm to 8 am, and Saturday/Sunday all day), 60% (403) of the patients contacted the telemedical center, whereas fewer consultations (269, 40%) were recorded during 'office hours' (Monday to Friday, 8 am to 6 pm; Fig. 3).

Although most calls related to dental trauma were recorded on Saturdays (18.3%), this was not statistically significant different ($P = 0.36$) from on weekdays. The frequency of consultations over the year did not reveal a peak in any month ($P = 0.11$).

In 2007, almost 80% (96) of the people who called to receive counseling after a dental accident came from an urban area, whereas only 20.7% (25) came from a rural area. In the total sample of calls (medical and dental), an even greater percentage (198 090, 86.6%) came from urban areas than from rural regions (30 672, 13.4%). This difference between the regional origin of the total sample and the dental subgroup was statistically significant ($P = 0.023$).

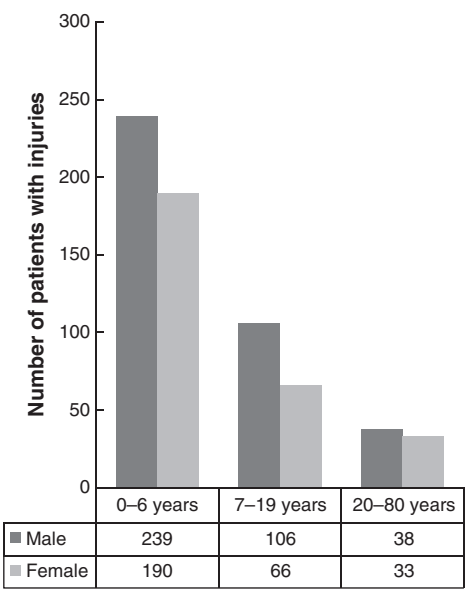

Fig. 1. Age distribution according to dentition, showing a high percentage of calls in the 0–6 years age group

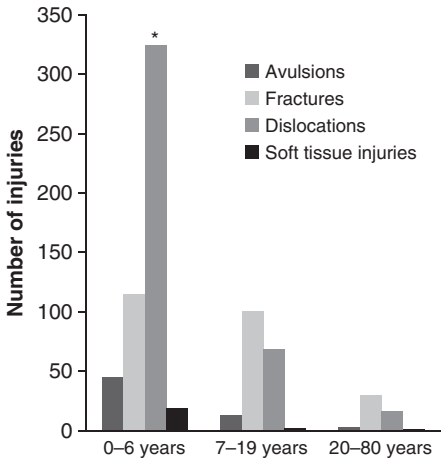

Fig. 2. Age distribution in different types of injuries. Dislocation injuries were significantly* more frequent in the 0–6 years age group than in the 7–80 years age group.

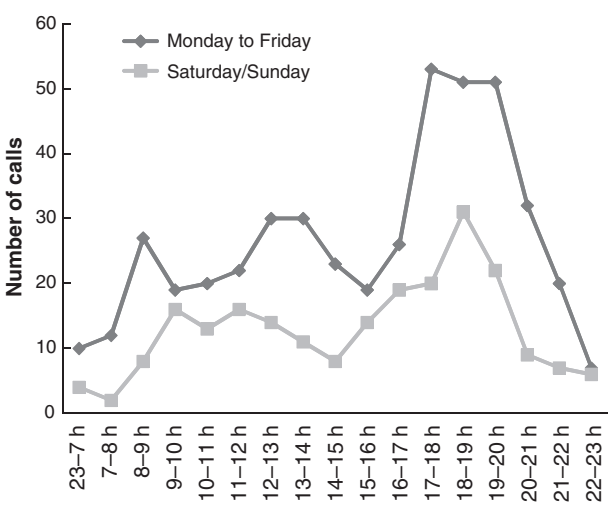

Fig. 3. Accumulated time distribution of calls. The activity patterns of incoming calls on normal working days were distinguished from those on weekends. Both curves show the highest number of calls in the late afternoon and evening hours.

Further professional treatment was considered as urgent in almost one-third of the cases (207, 30.8%). Consultation of a dentist was suggested in 22.8% (153) within 12–24 h, in 9.4% (63) within 24–48 h, and in 37.1% (249) after more than 2 days.

Discussion

In general, the term teledentistry describes the telemedical dialogue between a general dental practitioner and a specialist, to adequately assess the individual patient. The current retrospective study, however, has demonstrated that patients themselves take the initiative to communicate with telemedical professionals to a substantial degree.

Although the service provided by the telemedical center Medgate was primarily offered for medical issues, a considerable number of patients requested help with dental problems, especially following dentoalveolar injuries. These findings suggest that there is a need for telemedical care in the field of dentistry, particularly in dental traumatology.

The distribution of injury types coincides with previous reports irrespective of patients' age (33), and supports the claim that advice is needed in most instances of dental trauma. The higher prevalence of dislocation injuries in young children is in accordance with findings from the literature showing that this type of injury is more common in primary than in permanent dentition, possibly because of the alveolar bone structure in children being more elastic (34).

In the study period, most calls were registered during 'out of office hours'. A similar pattern was found in an epidemiological study in Sweden, which suggests that oral injuries are more likely than non-oral injuries to occur in the late evenings or over the weekend (1). Obviously, access to dental treatment from a dental practitioner or a dental clinic is less likely during this time frame.

The number of callers consulted Medgate during normal business hours (40%) when their dentist should have been reachable was unexpectedly high. It indicates that many people welcome the availability of telemedical help throughout the day.

More accidents were anticipated during the summer when people engage in more sport and outdoor leisure activities. Surprisingly, although, the number of calls were evenly distributed throughout the year.

Even patients who noticed discoloration in teeth, for example, as a late symptom of pulp necrosis, called Medgate to use the phone consultation as late as 1 week after the accident. In these cases, the accident itself, most likely a concussion or a minor dislocation, was obviously not of sufficient importance for the patient to justify an immediate consultation, unlike the subsequent discoloration of the tooth. Financial aspects may play a role since dental services are generally paid for by the patients themselves unless the accident is covered by insurance, whereas telemedical services are provided free.

In rural areas, the proportion of those calling for dental trauma was higher than in urban areas.

This is probably due to the network of dental services in rural regions being less dense, with better emergency services in urban areas.

Assuming telemedical centers can provide adequate guidance, they can extend care to patient populations with limited access or no access to dental care – thus improving emergency management after trauma.

The Swiss Government is currently considering making the use of telemedical services prior to a consultation of a medical doctor compulsory (35), in an attempt to make the national health services in Switzerland more cost-effective. Should consulting telemedical services become mandatory, the number of consultations by phone would probably increase 10–20 times and the number of requests for help in dental medicine would also increase proportionally.

Setting up and running telemedical centers is an expensive task. The professionals employed there must have regular further training to keep up to date.

Despite the high costs involved, an increasing number of countries are investing in telemedical services to support their healthcare systems (5).

Although the principle of the telephone triage remains the same, establishing telemedicine in a new country is not a matter of a simple knowledge transfer. The different insurance systems and health cultures in different countries make such a transfer difficult.

As dental emergencies are much less frequent than medical emergencies, a special teledental service offered by a public dental clinic would probably be too expensive to set up and run in most countries.

Possible solutions could be: (i) to train the physicians employed in the telemedical service better in the field of oral pathology, and/or (ii) to provide the telemedical service with backup assistance from dentists (or specially trained dental nurses) as part of their normal public emergency services.

As the majority of experts working at the Medgate call center were physicians and not dentists during the study period, their knowledge of dental trauma might be insufficient, as other recent studies in similar centers suggest (36, 37). Even general dental practitioners tend to have rather limited know-how in the field of dental traumatology (38).

The current retrospective investigation has some limitations. Thus, it was not possible to evaluate whether the documented diagnoses were accurate. However, basic diagnosing in dental traumatology is feasible even for lay people. For analysis, injuries were categorized into only three groups (avulsion, fracture, dislocation), facilitating the specification by the patient or the parent themselves.

Further, it was not possible to analyze the quality and appropriateness of the telemedical advice. The database does not contain records about whether given recommendations were followed by the patient. Qualitative studies in telemedicine are difficult because of the methodological problems involved in comparing the triage performance directly with the outcome (39).

Conclusion

This study has demonstrated that telemedical services can be helpful for cases related to dental trauma, and

centers may provide support when a dentist is not available. This includes calls from rural areas and during 'out of office hours'. Most of the calls in the database were related to injuries in the primary dentition. Further studies are, however, needed to determine whether telemedical centers can improve emergency treatment at the accident site.

Acknowledgements

The authors gratefully acknowledge the Swiss Center for Telemedicine Medgate, Basle, (Switzerland) for the supply of medical data. The authors would also like to thank Klaus Lienert, MD, for his valuable help.

References

1. Petersson EE, Andersson L, Sorensen S. Traumatic oral vs non-oral injuries. Swed Dent J 1997;21:55–68.
2. Glendor U, Andreasen JO. Classification, epidemiology and etiology. In: Andreasen JO AF, Andersson L, editors. Textbook and color atlas of traumatic injuries to the teeth. Copenhagen: Munksgaard; 2007. p. 217–54.
3. Glendor U. Has the education of professional caregivers and lay people in dental trauma care failed? Dental Traumatology 2009;25:12–8.
4. E-Health ISfTE. Glossary of telemedical terms. In: E-Health ISfTa. 7th International Conference on Telemedicine. Regensburg, 2002.
5. Bunn F, Byrne G, Kendall S. Telephone consultation and triage: Effects on health care use and patient satisfaction. Cochrane Database Syst Rev 2004:CD004180.
6. Bunn F, Byrne G, Kendall S. The effects of telephone consultation and triage on healthcare use and patient satisfaction: A systematic review. Br J Gen Pract 2005;55:956–61.
7. Lattimer V, George S, Thompson F, Thomas E, Mullee M, Turnbull J et al. Safety and effectiveness of nurse telephone consultation in out of hours primary care: Randomised controlled trial. The south wiltshire out of hours project (swoop) group. BMJ 1998;317:1054–59.
8. Lattimer V, Sassi F, George S, Moore M, Turnbull J, Mullee M et al. Cost analysis of nurse telephone consultation in out of hours primary care: Evidence from a randomised controlled trial. BMJ 2000;320:1053–57.
9. Lattimer V, Turnbull J, Burgess A, Surridge H, Gerard K, Lathlean J et al. Effect of introduction of integrated out of hours care in england: Observational study. BMJ 2005;331:81–84.
10. Kopycka-Kedzierawski DT, Bell CH, Billings RJ. Prevalence of dental caries in early head start children as diagnosed using teledentistry. Pediatr Dent 2008;30:329–33.
11. Kopycka-Kedzierawski DT, Billings RJ. Teledentistry in inner-city child-care centres. J Telemed Telecare 2006;12:176–81.
12. Mandall NA, O'Brien KD, Brady J, Worthington HV, Harvey L. Teledentistry for screening new patient orthodontic referrals. Part 1: A randomised controlled trial. Br Dent J 2005;199:659–62. discussion.
13. Park W, Kim D-K, Kim J-C, Kim K-D, Yoo SK. A portable dental image viewer using a mobile network to provide a teledental service. J Telemed Telecare 2009;15:145–49.
14. Torres-Pereira C, Possebon RS, Simoes A, Bortoluzzi MC, Leao JC, Giovanini AF et al. Email for distance diagnosis of oral diseases: A preliminary study of teledentistry. J Telemed Telecare 2008;14:435–8.
15. Nickenig H-J, Wichmann M, Schlegel A, Eitner S. Use of telemedicine for pre-implant dental assessment - a comparative study. J Telemed Telecare 2008;14:93–97.
16. Cook J, Edwards J, Mullings C, Stephens C. Dentists' opinions of an online orthodontic advice service. J Telemed Telecare 2001;7:334–37.
17. Mandall NA, Qureshi U, Harvey L. Teledentistry for screening new patient orthodontic referrals. Part 2: Gdp perception of the referral system. Br Dent J 2005;199:727–9.
18. Nuttall NM, Steed MS, Donachie MA. Referral for secondary restorative dental care in rural and urban areas of scotland: Findings from the highlands et islands teledentistry project. BrDent J 2002;192:224–8.
19. Stephens CD, Cook J. Attitudes of uk consultants to teledentistry as a means of providing orthodontic advice to dental practitioners and their patients. J Orthod 2002;29:137–42.
20. Chen H, Fricton J. Teledentistry: Seeing the doctor from a distance. Northwest Dent 2007;86:27–8. 68.
21. Chen RS, Chen SK. Teledentistry using videoconferencing and a dicom image management system. J Telemed Telecare 2002;8:244–6.
22. Cook J, Mullings C, Vowles R, Ireland R, Stephens C. Online orthodontic advice: A protocol for a pilot teledentistry system. J Telemed Telecare 2001;7:324–3.
23. Cook J, Mullings C, Vowles R, Stephens C. The use of teledentistry to provide gdps with advice in orthodontics. Dent Update 2002;29:249–55.
24. Scuffham PA, Steed M. An economic evaluation of the highlands and islands teledentistry project. J Telemed Telecare 2002;8:165–77.
25. Rocca MA, Kudryk VL, Pajak JC, Morris T. The evolution of a teledentistry system within the department of defense. Proc AMIA Symp 1999:921–4.
26. Birnbach JM. The future of teledentistry. J Calif Dent Assoc 2000;28:141–3.
27. Clark GT. Teledentistry: What is it now, and what will it be tomorrow? J Calif Dent Assoc 2000;28:121–7.
28. Clark GT. Teledentistry:Genesis, actualization and caveats. J Calif Dent Assoc 2000;28:119–20.
29. Golder DT, Brennan KA. Practicing dentistry in the age of telemedicine. J Am Dent Assoc 2000;131:734–44.
30. Sanchez Dils E, Lefebvre C, Abeyta K. Teledentistry in the united states: A new horizon of dental care. Int J Dent Hyg 2004;2:161–4.
31. Vandre RH, Kudryk VL. Teledentistry and the future of dental practice. Dentomaxillofac Radiol 1999;28:60–61.
32. Bundesamt für Statistik der Schweiz BFS. Die Bevölkerung der Schweiz 2007. Neuchâtel. 2008;7:3.
33. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries. A clinical study of 1,298 cases. Scand J Dent Res 1970;78:329–42.
34. Schatz JP, Joho JP. A retrospective study of dento-alveolar injuries. Endod Dent Traumatol 1994;10:11–14.
35. Schweizerischer Bundesrat. Botschaft betreffend die Änderung des Bundesgesetzes über die Krankenversicherung vom 29.5.09. 2009; 6.
36. Abu-Dawoud M, Al-Enezi B, Andersson L. Knowledge of emergency management of avulsed teeth among young physicians and dentists. Dent Traumatol 2007;23:348–55.
37. 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 Paediatr Dent 2003;13:13–9.
38. Krastl G, Filippi A, Weiger R. German general dentists' knowledge of dental trauma. Dent Traumatol 2009;25:88–91.
39. Derkx HP, Rethans JJ, Muijtjens AM, Maiburg BH, Winkens R, van Rooij HG et al. Quality of clinical aspects of call handling at dutch out of hours centres: Cross sectional national study. BMJ 2008;337:a1264.