Smartphones and dental trauma: the current availability of apps for managing traumatic dental injuries

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Abstract – Background/Aim: There is a general consensus regarding the lack of awareness regarding the emergency management of traumatic dental injuries amongst laypersons and dental professionals. This article aims to provide an overview of the apps available for traumatic dental injuries using smartphones. These apps may serve as a gateway for raising awareness of traumatic dental injuries. Materials and method: Three smartphone devices were used to access their respective app stores (Nokia Lumia 635 with Windows Phone OS 8.1; iPhone 5 with iOS 8.1; Samsung Galaxy Ace II with Android OS v2.3.6 Gingerbread). Nine phrases were searched: broken tooth/teeth; chipped tooth/teeth; dental emergency; dental injury; dental trauma; fractured tooth/teeth; knocked-out tooth/teeth; tooth/teeth injury; and tooth/teeth trauma. Results: Seven apps for the Android and one app for the Apple operating system were relevant. The only Apple iOS app retrieved (Dental Trauma) was also found for the Android OS (Dental Trauma First Aid) and had the endorsement of the International Association of Dental Traumatology. AcciDent was the only app dedicated to traumatic dental injuries targeted solely towards dental professionals. Five other apps (Chipped Tooth Solution, Dental Crown Repair, Fixing Cracked Tooth, Repairing the Front Tooth and Solution to Broken Tooth) appeared to come from the same source (KBES). No traumatic dental injury apps were found for the Windows Phone OS. Conclusion: There are apps available for both patients and dentists that range in quality and on the whole lack real-life photographs. Future apps should continue to provide good quality, evidence-based and validated material.

Traumatic dental injuries are a major problem in oral health in childhood with little known about the prevalence in adults, and both are associated with high costs and personal/emotional burden. As the prevalence of dental decay continues to reduce in the Western world, dental trauma injury plays a significant part in causing dental morbidity and tooth loss (1).

This is especially so in the case of a tooth avulsion. Subsequent appropriate management is essential to preserve the health of an avulsed tooth. The lack of awareness regarding the emergency management of dental trauma injury among parents (2), school teachers, (3) sports coaches (4), and accident and emergency doctors (5) has been reported. Even within the dental profession, the level of knowledge amongst dentists appears to be heterogeneous (6, 7).

It seems that previous traumatic dental injury experience amongst mothers appears to have an impact on knowledge of dental trauma management (8). The importance of audiovisual methods in transmitting an educational message and improving the knowledge of tooth avulsion has been reported (9), and displaying educational posters prominently has been suggested as a clear, accessible and low-cost method of presenting the appropriate procedures to follow after oro-dental injury (10).

Al-Sane et al. (11) found the Internet, healthcare professionals and television were the three most preferred sources of information on the emergency management of tooth avulsion. The study found that younger adults, single people and subjects with higher education significantly preferred the Internet while older adults preferred television.

Hence, access to information is now reaching new heights. The traditional mobile phone was used for making and receiving calls and sending and receiving text messages. However, a smartphone, while it retains the functions of a traditional mobile phone, has additional computing capabilities. This allows Internet browsing, video streaming and gaming as just some of the possibilities of a smartphone device. There is also the ability to download additional pieces of software, applications (apps), which increase the range of possible functions of a smartphone.

Khatoon et al. (12) reported an abundance of apps that could be used dental education; however, they
concluded that there was a need for the information to be of good quality, peer reviewed and validated. Similar results were found when orthodontic apps were reviewed with the study finding that much of the information was not validated (13).

This article aims to provide an overview of the apps available for traumatic dental injuries on three of the main operating systems for smartphones. Of particular interest would be apps that are targeted towards patients in the emergency management of tooth injury as well as practicing clinicians in the subsequent management of dental trauma.

Materials and method

Three smartphone devices were used to access their respective app stores on 28 November 2014. A Nokia Lumia 635 (Nokia Corporation, Nokia Group, Helsinki, Finland) with Windows Phone OS (operating system) 8.1 (Microsoft Corporation, Redmond, WA, USA) was used to search Apps for Windows. An iPhone 5 with iOS 8.1 was used to search the Apple App Store (Apple Inc., Cupertino, CA, USA). Finally, a Samsung Galaxy Ace II with Android OS v2.3.6 (Gingerbread) (Samsung Telecommunications, Suwon, Korea) was used to search Google Play (Google Inc., Mountain View, CA, USA).

Nine phrases that patients or clinicians might use to search for apps relating to dental trauma were chosen: broken tooth/teeth; chipped tooth/teeth; dental emergency; dental injury; dental trauma; fractured tooth/ teeth; knocked-out tooth/teeth; tooth/teeth injury; and tooth/teeth trauma. Where appropriate, both singular (tooth) and plural (teeth) terms were searched. These phrases were then entered into each smartphone’s app search facility to produce a list of available apps. The search output contains a brief description of the app that has been provided by the developer. This summary was used to determine how appropriate the app was to dental trauma. Information for each app was collected along with the star rating and number of ratings as well as the cost of the app to the user. Where appropriate, apps were downloaded for further evaluation.

Some apps featured a ‘lite’ and ‘full’ version; the former often being free to the user while the latter required the payment of a fee. In such cases, the two versions were counted as separate apps as accessible information would be different for both versions. Any non-English language apps were translated using Google Translate (Google Inc.). The apps were grouped for presentation into categories according to the type of app. Any non-health, general dental and medical apps were subsequently excluded. Only apps with a core content relating to dental trauma were included and analysed.

Results

The number of apps retrieved using the nine phrases (broken tooth/teeth; chipped tooth/teeth; dental emergency; dental injury; dental trauma; fractured tooth/teeth; knocked-out tooth/teeth; tooth/teeth injury; and tooth/teeth trauma) are shown in Table 1.

A large proportion of apps were grouped as ‘non-health’, and these were often gaming or utility related. There was an abundance of entertainment apps that ranged from the user having to remove dental decay from animated mouths, extract teeth or whitening treatment. Medical apps are often related to education in areas such as anatomy, general surgery and orthopedics. Some medical apps focused on multiple-choice questions or flash cards to help users prepare for tests and examinations. Dental apps included those about dental anatomy, dental terminology as well as a tooth-brushing timer. Dental practice apps were also included in the Dental category if they contained some information on traumatic dental injury. Apps in the preceding three categories were excluded, and those with a core content relating to traumatic dental injury were analysed further.

Duplicate apps from the phrase searches were deleted, and the resulting apps are shown in Table 2. There were seven apps for the Android and one app for Apple operating systems. The only Apple iOS app retrieved (Dental Trauma) was also found for the Android OS (Dental...
Table 2. Apps relevant to dental trauma on Android OS \( (n = 7) \) and Apple iOS \( (n = 1) \)

<table>
<thead>
<tr>
<th>App</th>
<th>Operating system</th>
<th>Operating system required</th>
<th>Current version</th>
<th>Updated</th>
<th>Size</th>
<th>Offered by</th>
<th>Developer website</th>
<th>Cost (£)</th>
<th>Score (1–5)</th>
<th>Reviews</th>
<th>Description</th>
<th>Target user</th>
</tr>
</thead>
<tbody>
<tr>
<td>AcciDent*</td>
<td>Android</td>
<td>2.3.3</td>
<td>2.2</td>
<td>17/11/14</td>
<td>6.5 MB</td>
<td>Zahnunfallzentrum (Universitätskliniken für Zahnmedizin und Universität Basel)</td>
<td>zahnunfallzentrum.ch</td>
<td>3.53</td>
<td>5</td>
<td>10</td>
<td>Information on diagnosis and treatment of dental trauma for those in general practice</td>
<td>Clinicians</td>
</tr>
<tr>
<td>Chipped Tooth Solution</td>
<td>Android</td>
<td>2.2</td>
<td>1.01</td>
<td>16/07/13</td>
<td>1.7 MB</td>
<td>KBES</td>
<td><a href="mailto:talal0x@gmail.com">talal0x@gmail.com</a> (only email provided)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Information on treatment of a chipped tooth</td>
<td>Patients</td>
</tr>
<tr>
<td>Dental Crown Repair</td>
<td>Android</td>
<td>2.2</td>
<td>1.01</td>
<td>16/07/13</td>
<td>1.3 MB</td>
<td>KBES</td>
<td><a href="mailto:talal0x@gmail.com">talal0x@gmail.com</a> (only email provided)</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>Information on how a broken crown is repaired</td>
<td>Patients</td>
</tr>
<tr>
<td>Dental Trauma</td>
<td>Apple</td>
<td>5.1.1</td>
<td>1.91</td>
<td>12/09/13</td>
<td>10.7 MB</td>
<td>Ulf Glendor (Linköping University)</td>
<td>dentaltrauma.se</td>
<td>1.99</td>
<td>0</td>
<td>0</td>
<td>How to take care of dental trauma at the scene of an accident for the general population: IADT endorsed</td>
<td>Clinicians &amp; Patients</td>
</tr>
<tr>
<td>Fixing Cracked Tooth</td>
<td>Android</td>
<td>2.1</td>
<td>1.9</td>
<td>04/09/13</td>
<td>3.9 MB</td>
<td>Ulf Glendor (Linköping University)</td>
<td>dentaltrauma.se</td>
<td>2.48</td>
<td>5</td>
<td>2</td>
<td>Information on treatment of a cracked tooth</td>
<td>Patients</td>
</tr>
<tr>
<td>Repairing the Front Tooth</td>
<td>Android</td>
<td>2.2</td>
<td>1.01</td>
<td>16/07/13</td>
<td>1.5 MB</td>
<td>KBES</td>
<td><a href="mailto:talal0x@gmail.com">talal0x@gmail.com</a> (only email provided)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Information on treatment options for repairing a front tooth</td>
<td>Patients</td>
</tr>
<tr>
<td>Solution to Broken Tooth</td>
<td>Android</td>
<td>2.2</td>
<td>1.01</td>
<td>16/07/13</td>
<td>1.3 MB</td>
<td>KBES</td>
<td><a href="mailto:talal0x@gmail.com">talal0x@gmail.com</a> (only email provided)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Information on treatment of a broken tooth</td>
<td>Patients</td>
</tr>
</tbody>
</table>

*AcciDent is also available on Apple iOS although it was not retrieved using any of the nine phrases.
No traumatic dental injury apps were found for the Windows Phone OS.

AcciDent was a multilingual app available in English and German for the Android OS and was the only app dedicated to traumatic dental injuries targeted solely towards dental professionals. In exchange for the £3.53 to download the software, the user is able to access information on a full range of clinical scenarios ranging from cracks in the enamel and crown fractures with pulp involvement to crown–root fractures (Fig. 1). On visiting the developers’ website (14), it was discovered that the app was also available for the Apple iOS; however, the app had not been retrieved using any of the phrase searches in this study.

The Dental Trauma app (Apple iOS) and Dental Trauma First Aid app (Android OS) were both identical and again, a fee of £1.99 for Apple iOS and £2.48 for Android OS has to be paid to download the app. The developer (15) has the endorsement of the International Association of Dental Traumatology (IADT), and the app is available in 18 languages. The app aims to increase knowledge among the general population on how to take care of traumatic dental injuries at the scene of an accident. The developers target their product particularly to parents, teachers and sport coaches, although any individual would find the information of value if faced with a dental trauma emergency (Fig. 2).

The remaining five apps (Chipped Tooth Solution, Dental Crown Repair, Fixing Cracked Tooth, Repairing the Front Tooth and Solution to Broken Tooth) were only available for the Android OS and appeared to come from the same source (KBES). These were all available for download without the need to pay a fee. All these apps shared a common theme, containing some information indicative of the app title along with dental news, photographs and videos. The information contained in the app provided a brief description of how a dental injury scenario would be managed by the dentist.

Discussion
Although numerous smartphone operating systems are available, only the three with the largest market share were searched. The International Data Corporation (16) reports on the worldwide market share of smartphones and in the second quarter of 2014, Android OS accounted for 84.7%, Apple iOS 11.7% and Windows Phone OS 2.5%. The other operating systems made up the remaining 1.1%. The market share is reflected, to a certain extent, by the number of apps that were retrieved using the phrase searches displayed in Table 1.

Nine phrases were chosen to search for apps relevant to traumatic dental injuries; however, 100% of apps yielded from the Windows Phone OS were inappropriate. Apple iOS only produced one app and Android OS seven apps related to traumatic dental injuries. This illustrates the difficulty that users may encounter when trying to access appropriate apps. Indeed, the app AcciDent was available for both Android OS and

![Fig. 1. A screenshot from the AcciDent app showing illustrations of some traumatic dental injuries.](image1)

![Fig. 2. A screenshot from the Dental Trauma First Aid app guiding the patient to the appropriate traumatic dental injury.](image2)
Apple iOS yet the phrase searches did not retrieve this app for the Apple iOS. Having looked at the development of this app, it appears as though it was initially for the German-speaking market and this may have some part to play in the difficulty encountered in finding this app for Apple iOS.

The app stores utilize the content of the title of the app and the description provided by the developer to identify the most appropriate keywords. Search facilities then use special algorithms to generate the results. Therefore, developers should ensure that there is accuracy in their titles and descriptions. It would appear that the search criteria ‘dental trauma’, ‘dental injury’, ‘tooth trauma’ and ‘tooth injury’ produced the most useful results.

AcciDent appeared good value for money given the breadth and depth of information offered. Ten reviews of this app gave an average score of 5 of 5. Although no formal endorsement by the IADT, the developers at the University of Basel have produced an app with concise information, together with illustrations on the full range of dental trauma scenarios. Clinical photographs are lacking, but these have perhaps been excluded to standardize the presentation of the different scenarios. Nevertheless, this would be an excellent and useful app for both patients and dentists alike.

The Dental Trauma app (Apple iOS) and Dental Trauma First Aid app (Android OS) would also be of value to patients and dentists. The developer at the University of Linköping has the endorsement of the IADT which should reassure dentists that the advice offered is based on the most up-to-date scientific evidence. The current gold standard for the management of traumatic dental injuries has been well documented by the IADT, and these apps should be seen as a source of valid dental trauma information (17–19). Again, clinical photographs are lacking and illustrations help to guide the user in the emergency management of the full range of dental trauma scenarios. The app has been translated into 16 languages to ensure that it has worldwide appeal, and although there were only 2 reviews, the average score was 5 of 5.

The remaining five apps (Chipped Tooth Solution, Dental Crown Repair, Fixing Cracked Tooth, Repairing the Front Tooth and Solution to Broken Tooth) which all came from a common source provided brief advice on the management of specific dental problems. This would require the user to have numerous apps installed on a device and then open the app corresponding to the dental problem encountered. These apps appeared commercial in nature and contained significant information unrelated to dental trauma making them of limited value as a source of useful information.

A number of apps, which were produced for practice marketing, were excluded; however, some of these did contain information on the management of dental trauma. As apps are often relatively small and specialized programs, the depth of information available on the practice apps was often limited and patients may find accessing appropriate information less straightforward than if using specific dental trauma apps.

In the field of prosthetics, a mobile app was tested that allowed patients to take pictures of their own oral cavity parts that require dental treatment allowing the provision of professional advice much more quickly (20) This allowed dentists to arrange their appointments for patients with sudden worsening of prosthesis function. There is perhaps scope for a collaborative app for traumatic dental injuries to offer such a feature.

Both an audiovisual method (9) and the Internet (11) have been described as effective methods of educating younger people in the field of traumatic dental injuries. Dental trauma UK is a charity that was recently launched (21) and is exploring innovative ways of using social media and moving animation, the latter of which formed the basis of so many of the dental gaming apps retrieved in this study. These methods could be used to engage and educate younger people who are often the victims of traumatic dental injuries.

The limitations of this study mirror those of a study carried out on the availability of orthodontic apps (13). The ratings which users provide are subjective and are inherently moving targets as new reviews and ratings are added. Given the rapid pace of development of apps, by the time of publication, some apps will have been added, while others will have been removed.

The ability for almost anyone to post almost anything on the Internet remains a concern. There is, at present, no way to regulate the content or validity of the information in downloadable apps, and this is evident from the range in quality of the apps reviewed in this article. Instead, smartphone users must independently verify the information provided and the extent to which information in an app is accurate and trustworthy is therefore highly variable. A call for developers to provide good quality, evidence-based and validated material has been made (12, 13, 22), and this needs to continue. It was reassuring to see that the Dental Trauma app (Apple iOS) and Dental Trauma First Aid app (Android OS) were endorsed by the IADT.

Despite these advances in technology, traditional methods for imparting advice to our patients should not be forgotten. Parents of recalled patients have been found to be somewhat more knowledgeable about dental trauma management, and this could suggest that the dental visit can be an effective vehicle for education (23). The importance of moving from ‘treating’ towards ‘managing’ risk factors and prevention also remains a high priority (1).

Conclusion

There are apps available for both patients and dentists in the emergency management of traumatic dental injuries. The apps range in quality and on the whole lack real-life photographs. Future apps should continue to provide good quality, evidence-based and validated
material and perhaps employ methods such as moving animation and social media that younger people are using every day.

References
