The Efficacy of Mobile Teledentistry in Dental Screening

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The Problem

- Despite progress in oral health in the past decades, healthcare disparities do exist (1).

- The majority of marginalized populations have poorer oral health (2).

- Caries is the second most costly diet-related disease.

- In 2013-14, the total expenditure on dental care increased to $9 billion (3).
The Problem

- Dentistry faces labour issues, particularly maldistribution of dental labour (4).
- Private sector remains the primary dental care delivery system in Australia (4).
- Regular screening can prevent or halt the progress of caries.
- Despite direct visual examination remains the primary screening technique, this method has limitations.
Potential Solution

- DSLR camera is a better device in terms of image quality. However, its relatively large size and weight make it less convenient.

- Intraoral camera often produces poor image quality.

- Smartphone camera is readily accessible, provides satisfactory images and enables users to store and share data.
Potential Solution

- Mobile teledentistry refers to the integration of cellular technology and store-and-forward into oral care.

- The introduction of smartphone into tele-audiology and teledermatology has proven beneficial (5,6).

- However, research evidence on the use of smartphone in dental research is rare.
Aim & Objectives

Aim:
- To evaluate the efficacy of teledentistry approach to screen for dental caries.

Objectives:
- To determine the diagnostic accuracy of teledentistry approach to caries detection compared to the visual examination.
- To determine the diagnostic reliability of teledentistry approach to caries detection compared to the visual examination.
System Architecture

- A telehealth system “Remote-i”, based on store-and-forward, was developed by AEHRC, to work as a platform for data storage and management.

- An image acquisition android App “Teledental” developed to facilitate capturing photos and transmitting data to the server (7).
Teledentistry approach to dental screening involves acquiring photos from participants’ mouths using a smartphone camera.

Patient information and dental photos were transmitted from the android App to the Remote-i, for later scoring by a screener (7).

An off-site dental practitioner access the database from his/her desktop to assess records and prepare treatment plan.
One hundred regularly attending patients at a dental clinic enrolled in this study.

Each participant received visual examination by a dentist to record caries according to WHO protocol (8).

In a separate room, photos of participant’s teeth (5 photos/patient) were obtained using smartphone camera.
Outcome Measures

- Reviewing of dental photos was conducted by two dental practitioners (screeners).

- Screeners access the database to review dental photos and record findings on a pre-defined chart.

- These assessments form the database which was compared to the benchmark visual assessment.
Results

- Mean sensitivity for the photographic assessment (by two screeners) as compared to the visual screening was 61%.

- Inter-examiner agreement between two screening methods (photographic and visual), ranging from moderate to substantial (Kappa = 0.57 - 0.61).

- Intra-examiner agreement for the photographic assessment was almost perfect, with Kappa = 0.89.

<table>
<thead>
<tr>
<th></th>
<th>Benchmark Vs. Screener 1</th>
<th>Benchmark Vs. Screener 2</th>
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</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>62%</td>
<td>60%</td>
</tr>
<tr>
<td>Specificity</td>
<td>97%</td>
<td>98%</td>
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<tr>
<td>Kappa (95% CI)</td>
<td>0.57 (0.48-0.66)</td>
<td>0.61 (0.52-0.70)</td>
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*Benchmark* = Visual dental screening  
*Screeners* = Offsite practitioners who assess dental photographs
Limitations

- In some cases, there was poor image quality or unclear oral anatomy.
- Up to 15% of the screened teeth were not amenable to be scored.
- Such shortcomings could contribute to the suboptimal sensitivity and specificity.
Conclusions

- Teledentistry has the potential to detect caries from photographs with an acceptable diagnostic level, compared to the direct visual screening.

- Further cost-analysis research is required to determine whether teledentistry can reduce costs, compared to the traditional screening.
Implications

- Perform screening to identify high-risk groups and provide a treatment pathway for those who require urgent intervention.

- Teachers, parents or caregivers obtain photographs from children for a dental expert to assess at distance.

- A low-cost mid-level practitioners can be employed to perform teledental screening and prepare treatment plan.


