Original Research Article

# Smart app for smart diagnosis: Whatsapp a bliss for oral physician and radiologist

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## Abstract

**Background:** Health care has changed dramatically by the scientific blend of telecommunication and smart phones. The result of which is the teledentistry, an innovative field that involves the exchange of clinical information and images over remote distances for consultation and treatment planning by linking them with the specialists in larger communities. WhatsApp Messenger is cross-platform mobile messaging application that demonstrated its utility and efficacy in various clinical setting.

**Aim:** To assess the perception level regarding WhatsApp mobile based application among Oral Medicine and Radiology specialists in India.

**Methods:** A descriptive cross sectional web based online survey was conducted among the total of 100 Oral Medicine and Radiology specialists across India. A self-administered structured questionnaire was used to assess their perception level (12 items) regarding WhatsApp application. The response format was based on 5-point Likert scale. Analysis of variance, t-test was utilized for statistical analysis. Other part of the questionnaire recorded demographic data and other assorted questions.

**Results:** 83(95.40%) subjects use Teledentistry in Oral Medicine and Radiology practice. Statistically significant result was found in different age group and years of practice with respective use of teledentistry in practice. The mean score for perception regarding WhatsApp was 41.95. Data analysis revealed that age group and years of work experience were significantly associated with perception level score (p=0.0001). 63.51% subjects strongly agreed sharing patient's information in the "Whatsapp" leads to breach in the patient confidentiality.

**Conclusion:** The use of smart phone teledentistry is an efficient and effective way for remote specialist consultation. Other than patient confidentiality concern, majority of the subjects in this study shows positive assessment for the use of WhatsApp application in Oral Medicine and Radiology.

**Keywords:** Teledentistry, WhatsApp, Oral Diagnosis, Questionnaire, Teleconsultation.

## Introduction

Technological advances have revolutionized the face of dentistry and in pursuit of better oral health care delivery; the branch of "Teledentistry" (TD) emerged. Teledentistry can be defined as the use of electronic information and telecommunications technologies to support long-distance clinical oral health care, patient and professional health-related education, public health, and health administration.[1] Cook in 1997 defined "Teledentistry" as "The practice of using video-conferencing technologies to diagnose and provide advice about treatment over a distance.[2]

There have been extensive technologic innovations in the field of Oral Medicine and Radiology (OMR) in recent years. Advances have been made in the use of smart phones, computers, telecommunication technology, digital diagnostic imaging services, devices and software for diagnosis and follow up. Using advanced information technology, the science of dentistry today has crossed much longer distances than it was ever able to. New information technology has not only improved the quality of management of dental patients, but also has made it possible for the oral physician to manage the patient at a distance.

Tele-dentistry showed a 50% reduction in cost associated with preventing unnecessary transfers.[3] Similar studies using teledermatology verified a 51%

reduction in referrals by general clinicians who would have otherwise referred the patients to a specialist.[4] It was also reported that a teleconsulting system for preoperative consultation reduced from 43 to 10 the number of patients requiring the physical presence of a specialist for consultation before dento-alveolar procedures.[5] Other studies[6-8] showed positive confidence regarding functionality of Tele-radiology related to oral and paraoral structures.

Research on the use of e-mail for diagnosing oral diseases, as well as dedicated Teledentistry systems, has revealed several limitations: (1) the time required to procure digital photos of an oral lesion, transfer photos to a device connected to the Internet, and forward the pictures as an attachment; (2) the cost of intraoral cameras, digital cameras, and/or dedicated systems with a degree of performance adequate for capturing high-quality images; and (3) the consistent availability of these devices during oro-dental examinations.[9] Such limitations could be overcome by using smartphones and their applications as an easy alternative to the more deficient systems reported in the aforementioned studies.

The increasing number of smartphone users among health care professionals and patients has greatly enhanced the exchange of clinical records, in large part due to various software applications (e.g., WhatsApp, Viber, Wechat etc.). WhatsApp Messenger is widely

used instant messenger that allows for the exchange of messages, images, audio, or videos using an Internet connection. Its efficacy and utility has been demonstrated in various clinical settings like traumatology, plastic and reconstructive surgery and in emergency surgeries.[10-12]

Previous studies[13-16] has described the knowledge and attitude of general dentists towards Tele-dentistry, but to the best of our knowledge no previous study has evaluated the perception level of the OMR specialist regarding use of WhatsApp in the field of Oral Medicine and Radiology.

Against this background, the study was aimed to assess the perception level among OMR specialist about the practice of "WhatsApp" application as a channel of tele-dentistry.

## Materials and Methods

**Study Design:** A descriptive cross sectional online survey was carried among OMR specialist (n=100) in India to know the perception level towards mobile based "WhatsApp" (WhatsApp Inc. Mountain View, CA) application as a Tele-dentistry. List of OMR specialist's email was obtained from official website of Indian Academy of Oral Medicine and Radiology.

**Inclusion Criteria:**
1. Participant should be a life member of Indian Academy of Oral Medicine and Radiology

**Exclusion criteria:**
1. Annual member are not included in the study.
2. Participants who are not having Email id in the member list are excluded.
3. Incomplete questionnaires are excluded.

**Pre-testing of questionnaire:** An online electronic survey was created using the "Survey Monkey" web based survey tool. The online questionnaire was pilot tested on 10 OMR specialists to gain feedback on the overall acceptability of the questionnaire in terms of length and language clarity. Based on their feedback the questionnaire did not require any correction. Cronbach's coefficient was found to be 0.84, which showed an internal reliability of the questionnaire.

**Questionnaire:** Online questionnaire consists of 23 questions divided into three parts.
Part 1: This part consists of 6 questions regarding general demographic and professional background information like years of experience, type of consultation and usage type of Teledentistry in their practice.
Part 2: This section comprises of 12 questions dedicated to assess the knowledge, awareness and attitude of OMR specialist regarding use of "WhatsApp" application in the field of Oral Medicine. The participant's responses were ranked according to how much they agreed with each statement that was based on the 5 point Likert scale

with alternatives: strongly agree, agree, neutral, disagree and strongly disagree.
Part 3: This part is dedicated to difficulties facing while diagnosing over "whatsApp" application and other assorted total 5 questions.

**Methodology:** This survey was carried out in between March and April of 2016. 100 Subjects were randomly selected from official website of Indian Academy of Oral Medicine and Radiology. The questionnaire was sent to 100 OMR specialists through Email link generated by Survey Monkey web based tool. The identity of the subjects was kept anonymous, as an option was provided by the Survey Monkey web based tool. The email included an introduction letter explaining the research and seeking informed consent from participants. Reminder were mailed thanking respondents who had returned their surveys or reminding those who had not responded to complete and return the questionnaire at weekly intervals for 4 weeks. Responses after 4 weeks and incomplete survey were excluded from the study.

**Data Analysis:** Completed responses were entered into an Excel spreadsheet (Microsoft 2013) and coded for data analysis. The data were analyzed using Excel and SPSS 20 (SPSS Inc. Chicago, IL, USA). Descriptive statistics were used to summarize demographics and data. Data were expressed as frequencies and valid percentages. Each item of the part 2 questionnaire was coded from 1-5 (strongly agree to strongly disagree). Higher scores indicate positive appraisals towards perception level regarding "WhatsAppp" application, while the lower score indicate negative evaluation. A total score was calculated for each respondent by 12X5=60. Mean perception score, standard deviation, and frequency distribution were calculated.

## Results

The questionnaire was Emailed to 100 OMR specialist, 87 responses were returned, indicating a response rate of 87%. Demographic data shows that among 87 respondents 49 (56.32%) males and 38 (43.68%) females. Majority of the subjects were <45 years of age and 1-15 years of experience in the field of Oral Medicine and Radiology. Nearly half of the subjects (44.83%) work as an academician, oral diagnostician, oral radiologist and CBCT specialist. Among 87 respondents, 83(95.40%) subjects use different types "Teledentistry" in their practice.

Statistically significant results found in different age groups and years of experience of subjects (Table 1). There are various modes of "Teledentistry" in practice. "WhatsApp" smart phone application holds the 90.24% used as "Teledentistry" in their practice followed by Email, Viber and Hike (Fig. 1).

The mean perception score of the study population regarding "WhatsApp" were evident as 41.95. Subjects with <34 years of age had significantly greater

perception level (p=0.0001) than aged >45 years. Mean perception level decreased significantly with increased work experience (p=0.0001). No significant difference was found between different types of practice (Table 2).

(Table 3) shows percentage distribution of responses on 5 point Likert scale regarding perception towards "WhatsApp". Among 74 subjects who uses "WhatsApp" as a Teledentistry, 31 (41.89%) subjects agreed "Whatsapp" will help in diagnosing oral and para oral diseases while 2 (2.30%) disagree for the same. 25-29% subjects agreed or were neutral with the statement WhatsApp is good for dental education for training primary care dentist and students. >40% of subjects strongly agreed that WhatsApp is not only the foremost to monitor and follow up patients but also it can be used effectively in Oral Radiology for diagnosis. Same percentage of subjects shows positive response regarding usefulness of patient's video in diagnosis and treatment planning.

Majority of the subjects agreed or remained neutral in concerning with the use of WhatsApp is time saving and improve the relation with general dentist and other specialist. However, some statements regarding quality of images, confidentiality of the patient and possible potentiality of the WhatsApp in oral medicine and radiology showed negative response.

46(61.3%) subjects feel oro-facial pain is difficult to diagnose over WhatsApp followed by TMJ disorders, salivary gland disorders, inflammatory diseases and malignancies. Large number of OMR specialists get images for Teleconsulting from general dentists 44(59.45%) followed by other dental specialists, medical fraternity and from patient itself. 54(76.05%) subjects concur that they discuss about diagnosis and treatment plan in WhatsApp group chat room and 21(28.37%) subjects feels modification is required in WhatsApp application like improvement in the image quality, real time imaging like video call and conference call for multidisciplinary approach.
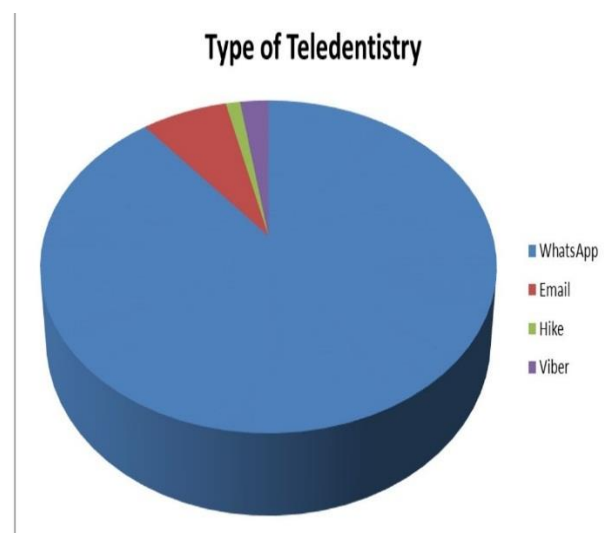


**Fig. 1: Different types of smart phone based Teledentistry**

**Table 1: Comparison of different demographic variables with use "Teledentistry" in practice**

| Factors | Yes | % | No | % | Total | Chi-square | p-value |
|---|---|---|---|---|---|---|---|
| **Sex** | | | | | | | |
| Male | 46 | 93.88 | 3 | 6.12 | 49 | 0.5946 | 0.4407 |
| Female | 37 | 97.37 | 1 | 2.63 | 38 | | |
| **Age groups** | | | | | | | |
| <=34yrs | 34 | 100.00 | 0 | 0.00 | 34 | 21.8623 | 0.0001* |
| 35-44yrs | 39 | 100.00 | 0 | 0.00 | 39 | | |
| >45yrs | 10 | 71.43 | 4 | 28.57 | 14 | | |
| **Years of experience** | | | | | | | |
| 1-5years | 31 | 100.00 | 0 | 0.00 | 31 | 33.8042 | 0.0001* |
| 5-10years | 38 | 100.00 | 0 | 0.00 | 38 | | |
| 10-15years | 11 | 91.66 | 1 | 8.33 | 12 | | |
| 15-20years | 2 | 66.66 | 1 | 33.33 | 3 | | |
| 20+years | 1 | 33.33 | 2 | 66.67 | 3 | | |
| **Type of consultation** | | | | | | | |
| Only academics | 24 | 96.00 | 1 | 4.00 | 25 | 1.9803 | 0.7394 |
| Oral diagnostician | 9 | 100.00 | 0 | 0.00 | 9 | | |
| Oral radiologist | 5 | 100.00 | 0 | 0.00 | 5 | | |
| CBCT specialist | 9 | 100.00 | 0 | 0.00 | 9 | | |
| All of the above | 36 | 92.31 | 3 | 7.69 | 39 | | |
| Total | 83 | 95.40 | 4 | 4.60 | 87 | | |

*p<0.05

**Table 2: Assessment of mean perception score regarding "WhatsApp" with demographic characteristics**

| Factors | | Mean | p-value |
|---|---|---|---|
| Sex | Male | 41.67±14.01 | 0.2770 |
| | Female | 41.61±9.92 | |
| Age groups | <=34yrs | 44.33±9.94 | 0.0001* |
| | 35-44yrs | 41.32±12.79 | |
| | >45yrs | 36.86±16.40 | |
| Years of experience | 1-5years | 42.67±0.58 | 0.0001* |
| | 5-10years | 41.94±10.05 | |
| | 10-15years | 40.25±13.78 | |
| | 15-20years | 39.71±13.25 | |
| | 20+years | 35.46±19.05 | |
| Type of consultation | Only academics | 41.24±11.42 | 0.4204 |
| | Oral diagnostician | 42.22±11.60 | |
| | Oral radiologist | 43.80±2.39 | |
| | CBCT specialist | 38.22±17.73 | |
| | All of the above | 43.28±12.46 | |
| | **Total** | **41.9540±12.41** | |

**Table 3: Percentage distribution of responses regarding perception towards "WhatsApp"**

| Question | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| "Whatsapp" will help in diagnosing oral and para oral diseases. | 11 (14.86%) | 31 (41.89%) | 18 (24.32%) | 2 (2.70%) | 12 (16.21%) |
| "Whatsapp" is good for dental education for training primary care dentist and students | 10 (13.51% | 20 (27.02%) | 21 (28.37%) | 9 (12.16%) | 14 (18.91%) |
| "Whatsapp" can help to monitor and follow up my patients oral health | 34 (45.94%) | 21 (28.37%) | 6 (8.10%) | 3 (4.05%) | 10 (13.51%) |
| "Whatsapp" can be used effectively in oral radiology for diagnosis | 37 (50%) | 16 (21.62%) | 10 (13.51%) | 1 (1.35%) | 10 (13.51%) |
| Quality of images in "Whatsapp" is better than other Teledentistry images | 10 (13.51%) | 12 (16.21%) | 21 (28.37%) | 15 (20.27%) | 16 (21.62%) |
| Videos of patient's and patient's data are useful in diagnosing and treatment planning | 33 (44.59%) | 21 (28.37%) | 8 (10.81%) | 2 (2.70%) | 10 (13.51%) |
| Sharing patient's information in the "Whatsapp" leads to breach in the patient confidentiality | 47 (63.51%) | 14 (18.91%) | 3 (4.05%) | 1 (1.35%) | 9 (12.16%) |
| "Whatsapp" can reduce isolation of general dentist by providing contact with oral physician/radiologist | 23 (31.08%) | 30 (40.54%) | 8 (10.81%) | 3 (4.05%) | 10 (13.51%) |
| "Whatsapp" is time saving for both patient and oral physician/radiologist | 28 (37.83%) | 24 (32.43%) | 10 (13.51%) | 2 (2.70%) | 10 (13.51%) |
| "Whatsapp" is best method for interdisciplinary approach for diagnosing and treatment planning | 15 (20.27%) | 24 (32.43%) | 17 (22.97%) | 6 (8.10%) | 12 (16.21%) |
| I think "Whatsapp" can increase accessible of the specialists to rural and underserved communities for their dental needs | 20 (27.02%) | 28 (37.83%) | 10 (13.51%) | 5 (6.75%) | 11 (14.86%) |
| "Whatsapp" has a potential to be integrated into our specialty | 11 (14.86%) | 3 (4.05%) | 32 (43.24%) | 11 (14.86%) | 17 (22.97%) |

## Discussion

Teledentistry is the use of electronic medical records, information and communication technology, digital imaging, and the internet to facilitate teleconsultation with specialists, supervision of collaborative practitioners at a distance and to continue education. Before the emergence of information and communication technology, dentists were often communicating via telephone or by sending patient clinical records via post, fax or telegraph. The rapid advance of technology and availability of the internet have increased the potential of telemedicine applications, speed, and methods by which practitioners and patients can interact.

The entire process of networking, sharing digital information, distant consultations, workup and analysis is built up with a segment of science of telemedicine concerned with dentistry called as "Teledentistry".[17] In

the present study, 83(95.40%) subjects utilize Teledentistry in practice. Similar results were found in the other studies performed by Berndt J et al[18] and Kopycka-Kedzierawski DT et al[19] which conducted on Orthodontists and Pedodontist respectively whereas present study conducted on OMR specialists. Interestingly, elder subjects >45 years shows negative response regarding use of Teledentistry in their practice, this may be due to fact that elder subjects find difficulty in adopting newer technology.

The evolution of wireless digital technology has created the ability for immediate remote dental consultation. OMR specialists can take advantage of this technology to remotely review oral lesions and maxillofacial imaging. m-teledentistry is the use mobile devices like smart phones, electronic health records and portable radiography. "WhatsApp" mobile based application has gained widespread use in oral medicine and radiology consultation. (Fig. 2 & 3)
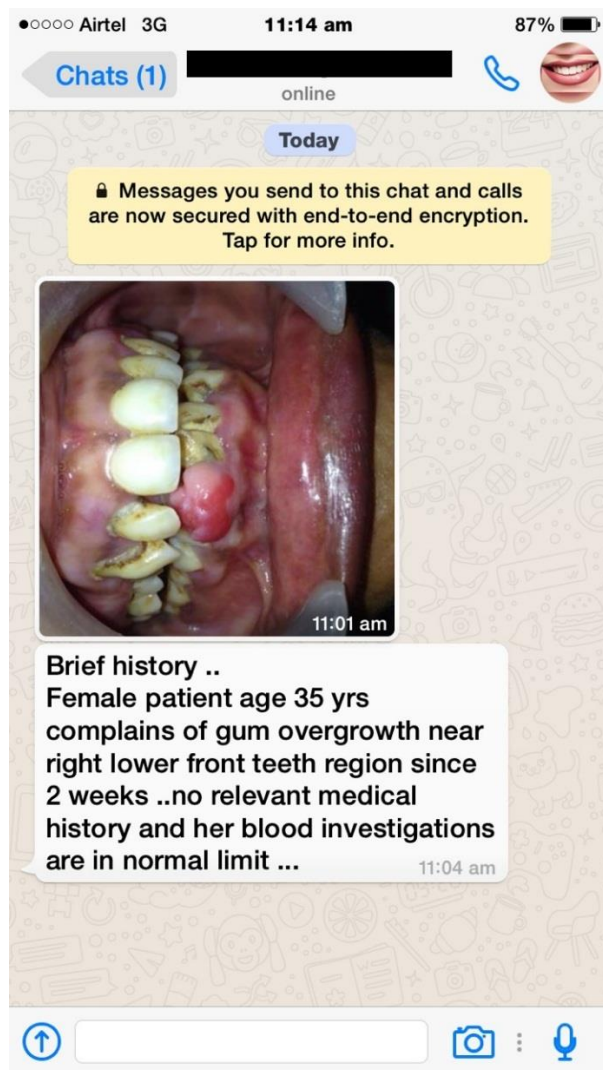


**Fig. 2: Soft tissue lesion sent over WhatsApp for consultation**
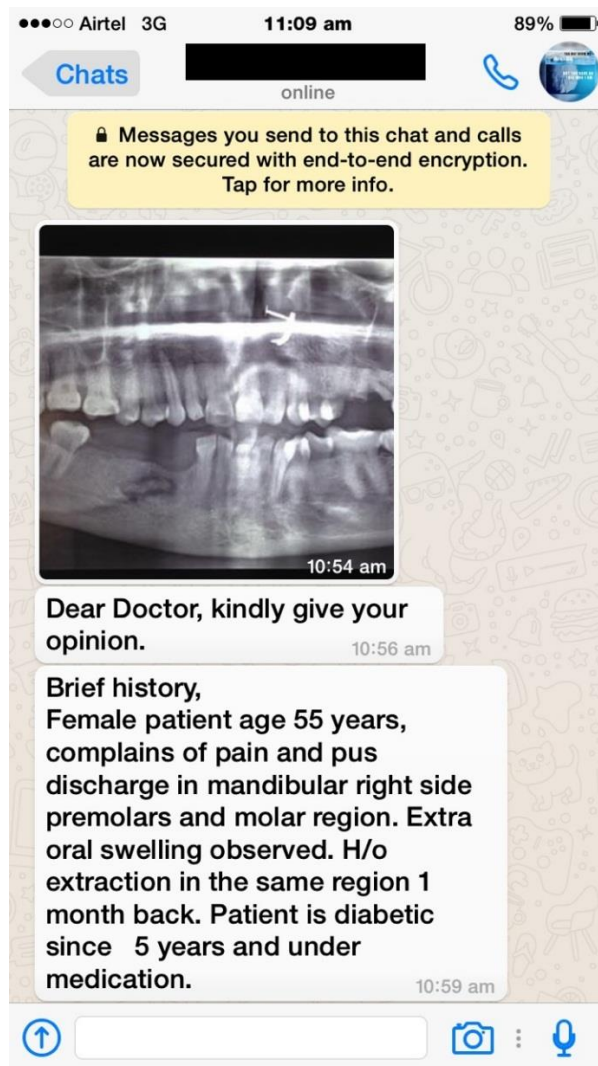


**Fig. 3: OPG sent over WhatsApp for opinion**

To our knowledge, this study is the first to evaluate OMR specialist's perception about the usefulness of WhatsApp smart phone application in Oral Medicine and Radiology. Generally, more optimism was expressed by respondents with respect to the advantages of WhatsApp for patients. Most respondents felt that WhatsApp would be useful in improving dental practice, patient management and patient satisfaction. In the present study, results showed that age, work experience and type of consultation are the strong predictors for perception level regarding WhatsApp. Subjects who were less than 34 years of age had high perception level than those who had more than 34 years of age. Also, subjects with <5 years of work experience had high perception score than >5 years of work experience. As, WhatsApp is a recent concept, elder subjects with more work experience had not familiar with new technology usage in teleconsultation. Similar results were found in the previous studies conducted by N. Ramesh et al[13] and Smith et al,[20] which exhibits on Teledentistry and computer literacy respectively, where as in the present

study stressed on WhatsApp application. The inference from the results may be due to the fact that the younger subjects are more aware and exposed to the use of technology and smart phone application.

There were no statistically significant results found in mean perception level in different types of consultation, in contrast CBCT specialists' shows remarkably less perception level. The possible reason for this result may be CBCT images required special software to analyze the images which the smart phones may not support, the amount of data is extensive and difficult to upload on WhatsApp and the image quality of the CBCT over WhatsApp is less.

Majority (>41%) of subjects agreed that WhatsApp not only aids in diagnosis, monitoring and follow up of the patient but also plays effective role in oral radiology. This results are in accordance with other studies.[14,21] But these studies were conducted to know the knowledge and attitude of general dentist regarding Teledentistry, where as present study performed on OMR specialists to study the perception level concerning WhatsApp application. Similar results[6,7] were also showed the productiveness of Teledentistry in Oral Radiology.

Most of subjects in the present study exhibit neutral or negative appraisal regarding dental education for training primary care dentist and students. In contradistinction, studies conducted by Johnson LA et al[22,23] reported that general dentists showed positive response to dental education and training by Teledentistry.

Quality of the images in Email and other mode Teledentistry exhibit superior standards in studies conducted by Jacobs et al[8] and Stephens et al.[24] In comparison, present study shows neutral or negative response regarding quality of images over Whatsapp. The probable explanation for this result may be that, WhatsApp based images compressed when transfer from one device to other device that leads to compromise in fine details of images and also difficult to observe the details of the lesion or radiology in smart phone screen.

In the present study, subjects showed optimistic results regarding utility of WhatsApp application is time saving for both specialist and patient, interdisciplinary approach and accessibility of the specialists to rural area. Similar results were found in the previous studies[25,26] on Teledentistry.

Surprisingly, in this study 47 (63.51%) subjects express that sharing patient's information in the Whatsapp leads to breach in the patient confidentiality. The reason may be attributed that, about 76% of subjects in this study agreed for they discuss about diagnosis and treatment plan in WhatsApp group chat room.

Major part of the subjects in this study finds difficulty in diagnosis and treatment plan for oro facial pain and TMJ disorders. This may be because clinically we rarely see signs of these disorders, so diagnosis and treatment plan cannot be made remotely as the patient needing oral health care.

The use of smartphone based WhatsApp application is an efficient and effective way for specialist consultation and should be considered by the OMR specialists. With the advent of improved technology, specifically the WhatsApp and other similar applications now has improved portability and accessibility. Smartphones provide fast and clear access to WhatsApp digital images and allows the OMR specialists to provide a rapid and effective insight about the case, not restricted by the constraints of a desktop. This in turn allows for improved efficiency of the specialty consultation and ultimately providing improved care to the dental patient.

Major strength of the study is, this is the first study in the field of Oral Medicine and Radiology to determine the perception level regarding "WhatsApp" mobile based application as a teledentistry tool among the OMR specialists. Shortcomings of the study are; smaller the sample size, so further study is needed with larger sample size and present study not determined the reliability of the "whatsup" application in diagnosis of lesions.

## Conclusion

Although several studies have confirmed the safety and efficacy of smartphone use in health care, it is important to be adequately trained and be aware of the possibilities and limitations of smartphone use. The ultimate goal is to improve oral health care in the general population, using all possible strategies, including communication technology. WhatsApp and similar applications is one strategy for facilitating everyday patient doctor interactions and providing faster clinical communication between oral health care professionals. This should help with early, correct, and swift management of oral pathologies.

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