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Effectiveness and Challenges of Tele-Dentistry and Factors Affecting It, During the Times of COVID-19 Health Emergency- A Perspective of Dental Professionals

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ABSTRACT

The present study was conducted to assess effectiveness and challenges of tele-dentistry and factors affecting it, during the times of COVID-19 health emergency among dental professionals. It was a cross-sectional questionnaire study conducted among dental professionals which was online. Mean age of Study participants were 32.3±3 years. Majority of study participants major challenges to practice of Tele dentistry during Covid-19 Pandemic was lack of proper infrastructure {(189 (91.3%)}, negative attitude of Dental professionals {(93 (44.9%)}, According to {172 (83.1%)} dental professionals there are many challenges for practicing Tele-dentistry. Dental professionals reported that effectiveness of Tele dentistry during Covid-19 is good but all together challenges were large to practice. Tele dentistry in India due to which its effectiveness decreases and factors effecting its effectiveness barriers were age, average number of patients seen per month before lockdown, and Practice closed due to Covid-19 outbreak.

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INTRODUCTION

Tele-dentistry can be defined as the remote provision of dental care, advice, or treatment through the medium of information technology, rather than through direct personal contact with any patient(s) involved. Within the dental practice, teledentistry is used extensively in disciplines like preventive dentistry, orthodontics, endodontics, oral surgery, periodontal conditions, and detection of early dental caries, patient education, oral medicine, and diagnosis. Some of the key modes and methods used in teledentistry are electronic health records,

Table 1: Demographic detail of study participants (N=207)

Demographic Variables		(N) %
Age in years	26-35 Years	68 (32.9)
	36-45 Years	88 (42.5)
	46-55 Years	37 (17.9)
	More than 55 Years	14 (6.7)
	Total	207 (100)
Gender	Male	128 (61.8)
	Female	79 (38.2)
	Total	207 (100)
Marital Status	Married	161 (77.8)
	Unmarried	40 (19.3)
	Widow/Widower	6 (2.9)
	Total	207 (100)
Education	BDS	100 (48.3)
	MDS	107 (51.7)
	Total	207 (100)
Specialty	Oral Medicine and Radiology	06 (5.6)
	Oral & Maxillofacial Surgery	15 (14.0)
	Prosthodontics Crown & Bridge	19 (17.8)
	Pedodontics	05 (4.7)
	Periodontics & Implantology	12 (11.2)
	Endodontics& Conservative Dentistry	22 (20.6)
	Orthodontics and Dentofacial Orthopedics	10 (9.3)
	Oral pathology	9 (8.4)
	Public Health Dentistry	9 (8.4)
	Total	107 (100)
Years of experience	1-5 years	79 (38.2)
	6-10 years	56 (27.1)
	11-15 years	60 (29.0)
	More than 15 years	12 (5.7)
	Total	207 (100)

electronic referral systems, digitizing images, teleconsultations, and telediagnosis. All the applications used in teledentistry aim to bring about efficiency, provide access to an underserved population, improve quality of care, and reduce oral disease burden (Khan and Omar, 2013).

Tele-dentistry is useful among all branches of Dentistry such as in Kopycka-Kedzierawski and colleagues conducted a series of studies addressing the role of teledentistry in the detection and diagnosis of early childhood caries through intraoral images Kopycka-Kedzierawski and Billings (2006) and their results suggested that teledentistry could be a potentially efficient means of screening school children for signs of early childhood caries (Kopycka-Kedzierawski *et al.*, 2007). The use of teledentistry in oral medicine and diagnosis was assessed through a study conducted in Belfast, Kopycka-Kedzierawski *et al.* (2008); Kopycka-Kedzierawski and Billings (2011) Northern Ireland, where the authors used a prototype teledentistry system as part of a service improvement scheme and found that teledentistry may represent an alternative approach to manage referrals in oral medicine (Bradley *et al.*, 2010).

Teledentistry offers a wide variety of clinical applications ranging from patients' records management, diagnosis, and clinical decisionmaking. Teledentistry has the potential to provide underserved patients with oral healthcare services and for that, we have to be prepared (Nimbulkar *et al.*, 2020). In addition to clinical applications, teledentistry can be a beneficial tool to decrease the disparity because it is quarantine (Patel *et al.*, 2020). In spite of the large

Table 2: OPD details of study participants(n=207)

OPD details		(n) %
Average number of patients seen per month before lockdown	1-20	45 (21.7)
	21-40	134 (64.7)
	More than 40	28 (13.6)
	Total	207 (100)
Nature of practice	Private sector	100 (48.3)
	Government sector	49(23.7)
	Academic sector	8(3.9)
	More than one type of sector	50(24.1)
	Total	207 (100)
Type of practice	Solo	91 (44.0)
	Group	22 (10.6)
	Hospital	45 (21.7)
	More than one type of practice	49 (23.7)
	Total	207 (100)
Location of Practicing field	Urban	94(45.4)
	Peri-urban	48 (23.2)
	Rural	21 (10.1)
	More than one type of location	44 (21.3)
	Total	207 (100)
Practice closed due to Covid-19 outbreak.	Yes	95 (45.9)
	No	8 (3.9)
	Only emergency patients	104 (50.2)
	Total	207 (100)
Average OPD during lockdown and unlock phase.	0-5	87 (42.0)
	6-10	82 (39.6)
	11-15	30 (14.5)
	More than 15	8 (3.9)
	Total	207 (100)

number of disciplines that can benefit from teledentistry and the wide range of applications, limitations to the use of information communication and technology still exist and ensure equality in the provision of oral healthcare services and moreover, various therapeutic options also have to be thought of which can be provided through teledentistry means (Reche *et al.*, 2020). The technology used in teledentistry enables the fast transfer of images, files, and documents and provides access to these information for specialists and practitioners (Khan and Omar, 2013).

During the times of Covid-19 pandemic has created unique challenges in ensuring healthcare. Nevertheless, the possibility of using telehealth systems and methodologies in dentistry, defined as teledentistry, could improve the quality and efficiency of dental health care.

Besides many advantages of Teledentistry, there are many challenges which decrease the effectiveness of Tele-dentistry in developing countries like India during Covid-19 emergency. There are studies in past which had assessed the barriers but factors affecting them has not been researched, which very important as manipulation of significant factors may increase the effectiveness and decrease the barriers of Teledentistry. Therefore, the aim of the present study is to assess this effectiveness and challenges of teledentistry and factors affecting it, during the times of covid-19 health emergency.

MATERIALS AND METHODS

The study was conducted in Ajmer city, Rajasthan. All the dental professionals of Ajmer city was the sampling frame. Those dental professionals running their clinics were included in the study. The link was sent to all through the IDA group on WhatsApp and all were sent personal links. Informed consent was

Table 3: Perspective of Dental professionals towards effectiveness of Teledentistry during Covid-19 Pandemic

Effectiveness of Tele-dentistry		N (%)
Q1. What are the different ways you are consulting the patient with an oral problem?	Tele-consultation	114 (55.1)
	Consultation face to face	54 (26.1)
	Referral	39 (18.8)
	Total	207 (100)
Q2. In this period of Covid-19 pandemic how much effective is teledentistry in clinical treatment of dental diseases	Very much effective	55 (26.6)
	less effective	115 (55.5)
	Not effective	37 (17.9)
	Total	207 (100)
Q3. In this period of Covid-19 pandemic how much effective is teledentistry in prevention of dental diseases	Very much effective	109 (52.6)
	less effective	71 (34.3)
	Not effective	27 (13.1)
	Total	207 (100)
Q4. Tele dentistry is not much effective in clinical dentistry and prescribing drugs only will leads to recurrence.	Completely Agree	69 (33.3)
	Partially Agree	81 (39.1)
	Partially Disagree	31 (15.2)
	Completely Disagree	26 (12.4)
	Total	207 (100)
Q5. In which part of dentistry, Teledentistry is most effective during Covid-19 pandemic?	Diagnosis	25 (12.1)
	Treatment	6 (2.9)
	Education	22 (10.6)
	Monitoring	21 (10.1)
	More than one part	129 (62.3)
	Equally effective in all	4 (2)
	Total	207 (100)
Q6. Tele dentistry is effective in reducing cost and saving time for dental professionals in the times of Covid-19 pandemic?	Agree	78 (37.7)
	Disagree	80 (38.6)
	Can't say	49 (23.7)
	Total	207 (100)
Q7. Tele dentistry is mainly effective in urban areas than in rural areas	Agree	156 (75.4)
	Disagree	29 (14.0)
	Can't say	22 (10.6)
	Total	207 (100)
Q8. Tele dentistry is not very effective in normal times that are before and after the pandemic.	Agree	109 (52.6)
	Disagree	58 (28.0)
	Can't say	40 (19.4)
	Total	207 (100)

availed, and ethical approval was availed, from an independent ethical committee.

Before the start of the main study, a pilot study was conducted on 10% of total samples, to test the validity and reliability of the questionnaire. Internal consistency and reliability of questionnaires were measured by applying Cronbach's-Alpha (α) and Test-Retest. The value obtained was α=0.84, Kappa (k) =0.76 Weighted Kappa (k_w) = 0.80. Those questions with less validity and reliability were removed. Feasibility of the study was also checked.

To increase the response rate, callbacks and link were sent 3-4 times to each study participants. To assess the perspective of Dental professionals, a questionnaire was prepared which consists of 4 parts, first part consists of demographic details of study participants, 2^{nd} part consists of OPD details of study participant and 3^{rd} and 4^{th} parts consists of questions includes effectiveness and barriers of Tele-Dentistry during the times of Covid-19 Health

Table 4: Perspective of Dental professionals towards challenges to Tele dentistry during Covid-19 Pandemic

Challenges of Tele-dentistry		N (%)
Q1. Tele dentistry is a challenging task to practice in rural area due to lack of proper infrastructure.	Agree	189 (91.3)
	Disagree	11 (5.3)
	Can't say	7 (3.4)
	Total	207 (100)
Q2. In India, the negative attitude of Dental professionals towards Teledentistry is a challenge to its use.	Agree	93 (44.9)
	Disagree	80 (38.6)
	Can't say	34 (16.5)
	Total	207 (100)
Q3. In India, fear of fraud in the online transfer of money by the patient is a big challenge in the practice of Teledentistry	Agree	132 (63.8)
	Disagree	21 (18.8)
	Can't say	54 (17.4)
	Total	207 (100)
Q4. Illiteracy of patient in use of the internet for Teleconsultation is Challenge in the practice of Teledentistry.	Agree	145 (70.0)
	Disagree	39 (39.1)
	Can't say	23 (15.2)
	Total	207 (100)
Q5. Lack of clinical treatment to the patient is a big challenge to the practice of teledentistry	Agree	57 (27.5)
	Disagree	28 (13.6)
	Can't say	122 (58.9)
	Total	207 (100)
Q6. In India, the traditional system of state-by-state licensing is a major challenge to the practice of teledentistry.	Agree	63 (30.4)
	Disagree	45 (21.7)
	Can't say	100 (48.9)
	Total	207 (100)
Q7. Limited knowledge about the software and instrument needed to practice Tele dentistry among Dental professionals is a challenge.	Agree	135 (65.2)
	Disagree	49 (23.7)
	Can't say	23 (11.1)
	Total	207 (100)
Q8. Lack of acceptance to Tele dentistry among dentists is also among the challenges.	Agree	82 (39.6)
	Disagree	89 (43.0)
	Can't say	36 (17.4)
	Total	207 (100)
Q9. In India, to practice Tele dentistry challenges are more than its effectiveness	Agree	98 (47.3)
	Disagree	68 (32.9)
	Can't say	41 (19.8)
	Total	207 (100)

emergency.

Statistical Analysis

Details about Demographic variable and OPD details and perspective towards effectiveness and challenges among dental professionals were assessed by using Statistical analysis and results were expressed in number and percentages. Analysis of Covariance was applied to assess the factors effecting the effectiveness and barriers of Teledentistry. Level of significance was kept at 5%.

RESULTS

Table 1 shows that majority of study subjects {88 (42.5%)} were belonged to the age group of 36-45 years. Male study subjects {128(61.8%)} were more than females. Years of experience of most of the Dental professionals {79 (38.2%)} was 1-5 years. Dental professionals with master's degree {107 (51.7%)}

Table 5: Perspective of Dental professionals towards the effectiveness and challenges of practicing Tele-dentistry

Effectiveness and challenges scale		N (%)
Effectiveness	High	48 (23.2)
	limited	123 (59.4)
	Low	36 (17.4)
	Total	207 (100)
Challenges	Many	172 (83.1)
	Some	35 (16.9)
	No challenges	0 (0.0)
	Total	207 (100)

was more than with a bachelor's degree. Mean age of Study participants were 32.3±3 years. Response rate of the present study was 85%.

Table 2 shows that Average number of patients seen per month before lockdown by 134 (64.7%) study participants was 21-40. Clinic of most of the study subjects {94(45.4%)} was Located in urban areas. Average OPD during lockdown and unlock phase was from 0-5 patients among {(87 (42.0%)}.

Table 3 shows that during Covid-19 Pandemic about 114 (55.1%) of Dental professionals had consulted the patients through Tele-consultation. According to 115 (55.5%) of study participants teledentistry less effective in clinical treatment and very much effective {109 (52.6%)} in the prevention of dental diseases. About 81 (39.1%) of study participants partially agree with the statement that Teledentistry is not much effective in clinical dentistry and prescribing drugs only will leads to recurrence.

Table 4 shows that according to the majority of study participants major challenges to practice of Teledentistry during Covid-19 Pandemic was lack of proper infrastructure {(189 (91.3%)}, negative attitude of Dental professionals {(93 (44.9%)}, fear of fraud in the online transfer of money {(132 (63.8%)}, Illiteracy of the patient in use of internet {(145 (70.0%)}, Limited knowledge about the software and instrument {(135 (65.2%)}, Lack of acceptance to Tele dentistry among dentists {82 (39.6%)}. In India, according to 98 (47.3), dental professionals to practice Tele dentistry challenges are more than its effectiveness.

Table 5 shows that according to majority of dental professionals {123 (59.4%)} think that effectiveness of Tele-dentistry in India is limited, according to {172 (83.1%)} dental professionals there are many challenges for practicing Tele-dentistry.

Tables 6 and 7 shows the impact of factors on effectiveness and barriers to teledentistry, it was reported that Factors which has a significant impact on the effectiveness of teledentistry was age (p=0.00), Average number of patients seen per month before lockdown (p=0.00), Years of experience (p=0.03*), Practice closed due to Covid-19 outbreak (p=0.00). While the factors effecting challenges were education (p=0.00), Average OPD during lockdown and unlock phase. (p=0.05).

DISCUSSION

The present study was conducted to assess the effectiveness and challenges of teledentistry during the times of covid-19 health emergency. Not many studies conducted in the past on this topic, so this research was conducted.

Till now a lot of articles have reported the advantages, applications, usefulness of practicing Tele dentistry Nutalapati *et al.* (2011) during Covid-19 pandemic which has provided a deep insight into this topic which really helped dental professionals, but in a country like India where ignorance about dental treatment was widespread and people were fearful in dental treatment during normal times and after warning of WHO about the dental treatment during Covid-19 pandemic, it was very difficult for dental professionals to provide clinical treatment to patients.

In the present study, the meaning of teledentistry was consultation about dental diseases on the mobile phone between patient and dentists. As the knowledge of Dental professionals was close to nil about the infrastructure needed in teledentistry, the scope of teledentistry is not very bright in India.

In the present study, the majority of study subjects belonged to the age group of 36-45 Years. In contrast to this in a study by Pradhan *et al.* (2019) majority of study, participants were of 20-30 years of age group. This may be due to the fact that in the present study, only dental professionals with age group more than

Table 6: Shows the impact of various factor on effectiveness and Challenges of Tele-Dentistry

	Effectiveness			Challenges		
	High	Limited	Low	Many	Some	No challenges
Covariates	b 95 % CI	b 95 % CI	b 95 % CI	b 95 % CI	b 95 % CI	b 95 % CI
Age in years						
26-35 Years	4.11 (10.38, 0.89)	10.82 (17.06, 6.81)	-18.9 (-29.0, 1.24)	-4.99 (-10.32, 6.79)	11.6 (15.2, 7.89)	-1.46 (-10.8, 3.44)
36-45 Years	7.90 (20.11, 2.61)	-0.09 (-4.13, 4.71)	3.78 (2.39, 8.90)	1.84 (0.33, 6.99)	-2.56 (-4.2, 14.1)	3.66 (5.6, 19.8)
46-55 Years	-13.01 (21.29, 0.02)	7.6 (0.04, 11.4)	-2.4 (-9.9, 8.36)	–8.9 (-12.0,8.9)	13.4 (21.90, 6.77)	4.88 (12.0, 21.9)
More than 55 Years	reference	reference	reference	reference	reference	Reference
p-value	0.00**	0.30	0.22	1.90	0.89	0.20
Gender						
Male	-0.23 (-1.31, 6.23)	-0.42 (-3.44, 11.23)	-0. 09 (-0.65, 1.27)	0.01 (0.71, 1.45)	-0.04 (-0.54, 1.69)	-0.35 (-41, 1.19)
Female	reference	reference	reference	reference	reference	Reference
p-value	0.32	2.30	1.00	0.19	0.05*	0.98
Education						
MDS	- 0.9 (–1.2, 3.0)	0.78 (-15.6, 18.9)	–11.6 (–24.5, 1.3)	3.3 (–4.8, 11.4)	1.3 (–6.9, 9.5)	0.1 (10.2, 12.3)
BDS	reference	reference	reference	reference	reference	Reference
p-value	3.57	2.91	1.02	0.00**	3.09	1.87
Years of experience						
1-5 years	0.5 (0.3, 0.7)	1.2 (0.8, 1.6)	0.8 (0.4, 1.1)	0.5 (0.3, 0.7)	1.2 (0.8, 1.6)	1.2 (0.9, 1.6)
6-10 years	1.0 (7.3, 9.3)	–0.9 (–18.0, 16.2)	–11.6 (–24.5, 1.3)	3.3 (–4.8, 11.4)	1.3 (–6.9, 9.5)	0.4 (11.0, 11.7)
11-15 years	1.22 (-2.89, 1.09)	2.88 (1.90, 4.26	-3.90 (-5.87, 7.89)	6.93 (0.56, 9.94)	1.45 (-2.11, 3.50)	11.89 (17/01, 5.88)
More than 15 years	reference	reference	reference	reference	reference	reference
p-value	0.08	1.23	0.03*	1.92	0.11	0.35

$p \leq 0.05$*

Table 7: Shows the impact of various factor on effectiveness and Challenges of Tele-Dentistry (Continued From Table 6)

	Effectiveness			Challenges		
	High	Limited	Low	Many	Some	No challenges
Covariates	**b 95 % CI**	**b 95 % CI**	**b 95 % CI**	**b 95 % CI**	**b 95 % CI**	**b 95 % CI**
Average number of patients seen per month before lockdown						
1-20	1.8(-3.5, 5.6)	0.97 (-1.8, 6.8)	4.6 (6.8, -3.7)	1.4 (6.8, -0.87)	3.9 (12.3, 1.5)	7.8(19.2,1.4)
21-40	3.9(–5.3, 13.2)	2.8 (–16.4, 22.0)	1.9 (–12.6, 16.3)	–0.1 (– 9.2, 8.9)	4.9(–4.2,14.1)	7.1(–5.6, 19.8)
More than 40	reference	reference	reference	reference	reference	reference
p-value	0.00*	1.47	0.10	1.00	0.43	2.33
Practice closed due to Covid-19 outbreak						
Yes	2.56(-4.77, 8.91)	4.10(0.12, 9.03)	13.48(5.77, 18.92)	5.02(0.15, 9.17)	4.01(-0.24, 6.77)	9.03(15.11, 2.19)
No	4.83(0.14, 10.47)	1.09(-1.53, 4.71)	0.02(-7.22, 6.31)	1.90(-0.88, 7.91)	-2.71(-6.21, 3.88)	-0.99(-10.32, 2.84)
Only emergency patients	reference	reference	reference	reference	reference	reference
p-value	0.00*	2.33	1.75	2.31	0.07	1.43
Average OPD during lockdown and unlock phase						
0-5	4.89(1.27, 9.32)	5.67(13.09, 0.22)	11.65(4.01, 18.23)	-16.34(-21.44,-10.28)	5.38(0.38, 10.27)	6.83(9.01, 0.87)
6-10	2.67(-3.44, 6.79)	1.08(-4.77, 7.81)	5.77(0.89, 10.56)	2.81(0.11, 6.91)	1.89(-0.47, 6.70)	7.11(1.28, 8.90)
11-15	1.03(-2.82, 4.77)	7.89(0.33, 14.62)	1.79(-0.98, 7.02)	7.29(2.45, 16.01)	4.68(0.03, 7.84)	5.89(1.29, 10.63)
More than 15	reference	reference	reference	reference	reference	reference
p-value	0.43	1.66	4.88	2.19	0.05*	0.12

$p \leq 0.05$*

25 years were included while in a study by Pradhan *et al.* (2019) postgraduate students were also included. In the present study males were more than females; the same results were shown in a study by Pradhan *et al.* (2019).

In the present study, majority of dental professionals were agreed with the statement that Teledentistry is a valuable tool in the prevention of diseases; same results were seen in the study by Aboalshamat (2020); Murererehe *et al.* (2017).

In the present study majority of dental professionals does not agree with the statement that Teledentistry is effective reducing cost and saving time for dental professionals in the times of Covid-19 pandemic. Contrary results were seen in the study by Aboalshamat (2020); Murererehe *et al.* (2017).

In the present study, major challenges to practice teledentistry in India during Covid-19 pandemic was lack of proper infrastructure, negative attitude of Dental professionals, fear of fraud in the online transfer of money, Illiteracy of patient in use of the internet, the traditional system of state-by-state licensing, Limited knowledge about the software and instrument, Lack of acceptance. In the study by Pradhan *et al.* (2019), major challenges in teledentistry are illiterates, population below the poverty line, and lack of infrastructure in India. In

a study by Aboalshamat (2020), major challenges were lack of patient compliance, violation of patient privacy, Low level of population education, Lack of current infrastructure. Still, no study has been reported, which explores factor which has a significant impact on effectiveness and barriers of Teledentistry, so dentists have to be prepared and learn teledentistry uses and other means by which the society can be benefitted in terms of appropriate oral healthcare (Singh *et al.*, 2020).

CONCLUSION

From above it was concluded that majority of dental professionals reported that effectiveness of Teledentistryduring Covid-19 is good, but altogether there were a large number of challenges to practice Teledentistry in India due to which its effectiveness decreases. Factors affecting its effectiveness barriers were age, an average number of patients seen per month before lockdown, Years of experience, Location of Practicing field, Practice closed due to Covid-19 outbreak, education, Nature of practice, Average OPD during the lockdown and unlock phase.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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