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Effect of Intraoral Camera on Periodontal Health - A Systematic Review

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Abstract

Background: Maintenance of oral hygiene has been thought to reduce periodontal problems. Manual aids and other interventions can maintain it.

Newer technologies like intraoral cameras also can be used to achieve oral hygiene.

Aim: To assess the effectiveness of intraoral cameras on periodontal health when compared to other interventions and aids for oral hygiene.

Methods: An article search was performed using PubMed, Ovid Medline, Elsevier science direct, Wiley online library, Cochrane library, Lilacs and Google Scholar using Mesh terms - Intraoral Camera, Tele dentistry and periodontal health. A total of 88 articles

were screened, 32 were full-text articles assessed for eligibility and 4 were taken for the qualitative analysis. This review was reported according to PRISMA guidelines. Four randomized control trials were included for the review process.

Results: The intraoral Camera was compared with other manual aids, digital technologies and other cameras showed statistically significant results in comparison with other aids. No meta-analysis was performed due to the clinical heterogeneity and differences in the reporting of data among the included studies.

Conclusion: Intraoral Camera was found to be effective in improving periodontal health and equally effective to other aids.

Keywords: Intraoral Camera, Tele dentistry and Periodontal health.

Introduction

The health status of the body gets reflected in the oral cavity. Many systemic diseases pertain to showing their symptoms in the oral cavity. Most of the systemic diseases show their symptoms related to the Periodontium. Deteriorated oral hygiene can lead to dental caries and Periodontal disease and linked to heart disease, cancer, and diabetes. Therefore, it is important to maintain oral health. The scope of health care may include educational interventions for children, parents, policymakers or health care providers. Other general measures to maintain oral health include brushing twice a day with toothpaste, flossing, decreasing the intake of alcohol, drinking fluoridated water and seeking timely professional dental care. In dentistry and other health areas, it has been well documented that desirable health behaviours are not obtained by correct information about health. However, knowledge obtained can help teach people about health and health care technologies.[1]

It is well known that the oral examination might be very important both in oral record charting and in the time for a dental health survey. In general, such kinds of physical examination for the oral field would be done as inspection, palpation, exploration, radio graphic examination. [2]

The success of dental treatment, including periodontal treatment, depends on repeated follow-ups and better communication with the patient.[3] Communication and proper visualization of the issue enable the dentist to make the patient understand the reality of the illness and the crucial importance of maintaining oral hygiene.[3]

Periodontal health depends upon effective control of dental plaque. [4] The persistence of bacterial biofilm on dental surfaces is the main aetiology of periodontal diseases. [8] Dental floss, in combination with tooth brushing and inter proximal plaque control, is the most effective way to prevent periodontal diseases. [4, 5]

Gingivitis and Periodontitis are the two most common inflammatory conditions related to the Periodontium.[6] The promotion of oral health prevents these periodontal diseases. [7] The above measures are not followed in all the countries, and hence oral hygiene is not improved prevalently. [6] In addition to these manual and conventional methods, newer method ologies are required to maintain and promote oral health, which in turn improves periodontal health. Many innovative technologies are being developed that can aid oral health care providers and clinicians to render health care effectively. Such novel techniques are generally non-invasive and easy to use, with many other benefits for patients and clinicians. One such device that has become an indispensable tool in the provision of oral health care is an intra-oral camera (IOC), which gained its inception in 1987.[8] The features in the intra-oral camera can have numerous applications in providing treatment and

communicating with experts regarding diagnosis, treatment decisions, and protocols.[8] The dentist and the patient can get a closer look at the specific area in the patient's oral cavity by the use of an intraoral camera.[9] Usage of an IOC enables patients to see the areas of greater accumulation, retention and difficulty in removing the biofilm and inflamed areas, thereby increasing the scope of maintaining oral health. [5] Even though IOC systems have such features, their role in periodontal health has not been voiced out much. Due to the lack of adequate literature on the effect of intraoral cameras on periodontal health, this study aims to systematically review the related articles to gain a shred of evidence.

Objective: To assess the effect of intraoral cameras on periodontal health when compared to other interventions.

Materials and methods

Study design: Systematic review of randomized control trials.

Eligibility criteria

Inclusion criteria

- Randomized control trials up to date.
- Full-text articles available in the search engine mentioned in the search strategy were included.
- Studies in which intraoral camera was used as one of the interventions for promoting periodontal health.
- Studies published in the English language.

Exclusion criteria

- Articles not related to the topic.
- Non-randomized trials.
- Studies in which intraoral camera was used for other purposes.
- Relevant article without full text.

Search strategy

Published literature on assessing the effect of intraoral cameras on periodontal health, including original literature and research papers in databases such as PubMed, Ovid Medline, Elsevier science direct, Wiley online library, Cochrane library, Lilacs and Google Scholar, were taken into study for review. An article search was performed to collect relevant data using keywords “Intraoral camera, Tele dentistry and periodontal health”.

Search engine

- Google Scholar
- PubMed
- Ovid Medline
- Science direct
- Cochrane library
- Lilacs
- Wiley online library

Figure 1: Flow diagram showing the number of studies identified, screened, assessed for eligibility, excluded and included in the systematic review.

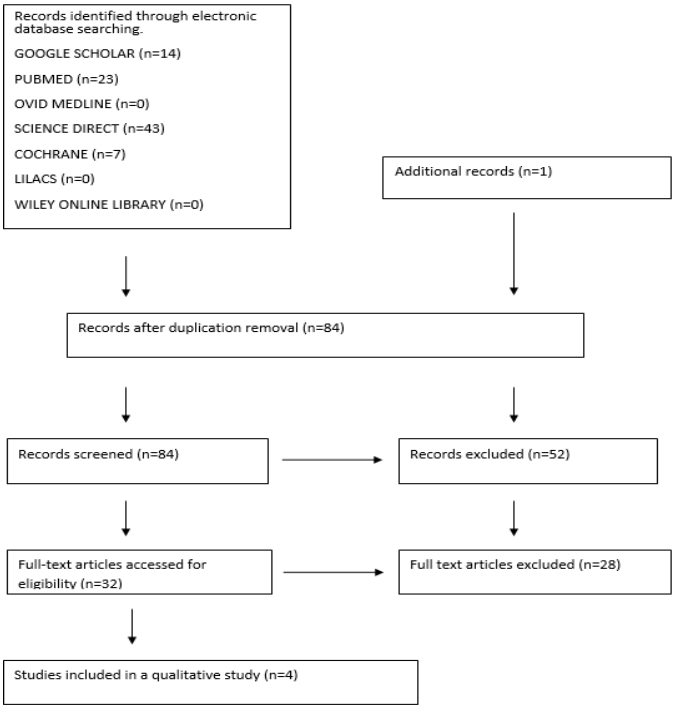

Table 1 shows the characteristics of the interventions in the included studies. In all four studies, the intraoral camera was compared with the SLR camera and other communi cation means such as tele messaging. But the studies differed based on the sample size, age of the population and the duration of the intervention. Three of the trials were performed among individuals with gingival inflammation and Gingivitis, and one trial was performed among healthy individuals. The subjects who participated in the studies had mild to moderate levels of plaque-induced Gingivitis.

Table 1: characteristics of the interventions in the included studies

Author Name	Year	Sample No.	Patient Characteristics	Duration	Number (Case/Control)
Araújo et al. [4]	2019	142	Subjects aged about 18-70 years who were willing to participate and those who had at least 20 permanent natural teeth and levels of inflammation over 0.5mm, out of which 84 were women	Eight months	Group I – Control Group II – IOC Group III – TM Group IV – IOC+TM
Araújo et al. [5]	2016	78	Adults aged above 18 years who were willing to participate and those who had Gingivitis receiving supportive periodontal therapy	Four months	Group I – Control Group II - IOC
Michael et al. [10]	2016	120	School children about 20 years of age who were willing to participate and those who had less than 20 teeth, partially erupted teeth, teeth with surface loss because of caries, clinically detectable gingival inflammation and periodontal disease.	One year	Group I (study group) – Provided with supervised tooth brushing and IOC – 60 individuals Group II (control group) – Provided with supervised tooth brushing – 60 individuals
Smith et al. [11]	2005	20	Patients of 18 years of age who were willing to participate and those who had fully erupted anterior teeth free from dental restoration	24 hours	Images were taken for the group of people using SLR and IOC cameras and compared.

Table 2 shows the outcome data of BOMP and plaque scores in the included studies. There was a forward-looking decrease in the plaque scores in the intraoral camera group related to the control group with a significant p-value.

Table 2: outcome of data as reported in included studies

Author name	Year	Effect measure	Results
Araújo et al. [4]	2019	Bleeding on Marginal Probing (BOMP), tooth brushing, flossing, HAPA model for measures of psychological determinants	There was no difference found at baseline in psychological behavioural aspects ($p>0.01$). BOMP levels were high at the baseline, and 80.8% of the participants never or hardly used dental floss
Araújo et al. [5]	2016	Bleeding on Marginal Probing (BOMP), dental hygiene (tooth brushing and flossing), flossing, HAPA model	There were no changes in the baseline psychological determinants and dental hygiene between the two groups. In the IOC group, recovery of self-efficacy was higher when compared to the control condition at four months with $p<0.05$ and maintenance self-efficacy was higher.
Machale et al [10]	2016	Comparison of plaque index	Comparison of the plaque index between groups I and II showed statistically significant differences ($p>0.05$ and $p<0.05$, respectively). In the study group, the percentage of plaque reduction from baseline to 30 days increased. Thereafter it

			remained stable for up to 12 months. In the control group, the plaque reduction percentage decreased from baseline up to 12 months.
Smith et al.[11]	2005	Plaque levels	Intra and Inter examiner results showed that 35mm SLR camera incorporated with image analysis system was more reliable.

Table 3 indicates the biased assessment of the included studies. Most of the studies and low risk of bias and most of the studies had an unclear risk of bias.

Table 3: bias assessment data as included in the studies

Author name, year	Random sequence generation	Allocation concealment	Blinding of outcome	Incomplete outcome data	Blinding of participants and personnel	Selective reporting	Judgemental bias
Araújo et al., 2019[4]	+	+	+	+	+	-	**?**
Araújo et al., 2016[5]	+	-	+	?	+	?	-
Machale et al., 2016[10]	+	?	+	+	+	-	?
Smith et al., 2005[11]	?	?	+	-	+	-	-

+ = low risk of bias; - = high risk of bias; - = unclear risk of bias.

Discussion

An intraoral camera which is frequently available in dental clinics is one of the upcoming technologies in dental practice. But this technology remains underused in support of oral health management. Usage of an intraoral camera, separately or in combination with other modalities, can significantly improve the overall status of the oral cavity.

This systematic review found results of the effect of using the intraoral camera in improving Perio dontal health. Among the four included studies, three studies reported statistically significant effects with a reduction in the scores measured from the baseline. One of the studies compared the usage of the intraoral camera with an SLR camera.

Araújo et al. reported that the usage of the intraoral camera along with tele messaging can be essential and can act as a significantly important gingival health indicator. Tele messaging usage could be due to ease of usage by the patient. The use of intraoral camera alone in improving the self-efficacy reported a significantly improved result, but it had a drawback of decreased motivational response [4].

Araújo et al. later reported that intraoral camera use favoured a significant reduction in bleeding, increase in the usage of dental floss and improvement in self-efficacy. This study discussed predominantly reducing the BOMP as gingival bleeding is the fundamental of Gingivitis. It also stated that IOC improves the behavioural aspects, which are essential for maintaining good oral hygiene, thereby implying good periodontal health [5].

Machaleet al. reported the effectiveness of supervised tooth brushing with and without the use of the intraoral camera. Comparison of plaque indexes revealed that there was a marked reduction in the plaque levels in the group, which followed supervised tooth brushing along with an intraoral camera. The reason could have been that IOC might have helped the children understand the plaque retention sites, which motivated the students to

maintain proper brushing even after cessation of the use of IOC [10].

Smith et al. compared IOC with an SLR camera and reported that usage of an SLR camera was more convenient for measuring the disclosed plaque areas. The probable reason could be the high accuracy and modification provided by the SLR camera, which aids the clinician's inaccurate measurement of plaque areas [11,12,13].

There is conclusive evidence that an intraoral camera is effective in improving periodontal health. It can also be used as a substitute or in combination with other aids to improve oral hygiene.

Conclusion

The use of an intraoral camera has a significant influence in curing periodontal problems and improving the overall periodontal health along with the improvement of behavioural aspects to maintain oral hygiene.

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