Effectiveness of Tele-Dentistry in Managing Oral Health of the Elderly in Rural Areas

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Abstract

A significant prevalence of unaddressed oral health requirements is prevalent among the older population. In an aging society severely impacted by the coronavirus, a global epidemic, formulating novel ways to improve overall and oral health is essential for fostering healthy aging. This systematic study aims to evaluate the viability of Teledentistry (TD) in community or home settings for elderly individuals. A thorough and organized investigation was conducted across key digital libraries for papers published in English: PubMed, Cochrane Libraries, Web of Science, Scopus, etc. Thirteen articles were discovered using a search of databases employing various keyword permutations. Of the 12 publications, eight abstracts were evaluated for alignment with the study's objective, and the complete texts were obtained. After abstract evaluations, seven papers were chosen for further examination. Out of them, six were evaluated for qualification. Four papers focused on assessing the experiences of clients and healthcare practitioners regarding TD, three investigations provided a cost evaluation and overview of TD in nursing homes, and two studies examined TD's potential benefits and accuracy for diagnosing dental pathological conditions. Integrating TD in aged-care institutions and home-assistance services is a practical solution for managing oral care for those unable to access dental services.

Keywords: Tele-Dentistry, Oral Health, Rural Areas, Elderly People.

1 INTRODUCTION

The worldwide population of elderly adults is expanding quickly. The population of individuals aged 60 and older is projected to almost double from 50 million in 2019 to 98 million by 2050 during the 45 years that follow (Li et al., 2025). As they age, older persons often acquire chronic healthcare and dental illnesses, with many older people experiencing several chronic ailments such as hypertension, osteoarthritis, lipid disorders, coronary artery disease, Type 2 diabetes, and mental health disorders, including Alzheimer's disease and other types of cognitive loss (Wei et al., 2022). Over the last fifty years, significant preventative and restorative dental treatment advancements have enabled older persons to preserve a greater portion of their original teeth. The percentage and number of elderly individuals have increased markedly. As a result, the need for oral health care for older persons has increased, necessitating thorough treatment of intricate oral health issues, such as periodontal conditions, cavities, root caries, gingivitis, oral epithelial lesions, and oral and pharyngeal malignancies (Lamont et al., 2022). These oral illnesses can be influenced or worsened by concurrent systemic

diseases. Access to oral health treatments is a significant issue for several older persons, particularly for those who are confined, residing in long-term care institutions, or living in remote regions.

Telehealth, according to definition by the World Health Organization (WHO) (Bouabida et al., 2022) refers to the provision of healthcare services where separation is a significant factor, facilitated by healthcare professionals utilizing technological devices to exchange accurate data for medical care, preventative study, assessment, and continuing education of medical professionals, all aimed at enhancing the well-being of people everywhere. Telehealth in dental environments is often called Teledentistry (TD) (Nassani et al., 2021). TD primarily aims to provide oral health treatments to at-risk communities and enhance access to specialized care.

TD and its implementation in elderly populations have not been extensively researched. The research aims to examine and delineate the existing research methodically on the applications of TD in older individuals, including its documented efficacy and constraints. This scoping study will provide insights to oral health physicians and academics about prospective applications of TD. A review of scope is distinct from a systematic review. A systematic examination aims to address a particular inquiry on current practices by methodically assessing the literature, culminating in synthesizing the extracted material to guide policy and procedure. A scoping review systematically evaluates literature to ascertain the extent of published material on a subject and to identify and delineate the available evidence (Auters et al., 2024). A scoping examination functions as a first step to a methodical examination and helps detect and assess gaps in understanding.

2 MATERIALS AND METHODS

This systematic review complied with the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines" (Sarkis-Onofre et al., 2021). The current systematic study procedure has been filed with the International Proactive Registry of Strategic Reviews in compliance with the standards.

2.1. Sources of Data

A structured and comprehensive investigation was conducted on the principal online databases for papers published: PubMed, Cochrane Libraries, Web of Science, Scopus, etc.

2.2. Search Methodology

The accompanying keywords were used to conduct database inquiries: " TD," "aging," "ages," "older," "elderly people," "geriatric," "nursing residences," "professional nursing home," "long-term treatment," "residential treatment," and "home support," in conjunction with the Boolean expressions "AND" and "OR." A preliminary search was conducted to verify the efficacy of the search method. The research concentrated on Population, Interventions, Control/Comparison, and Outcome(s) criteria. Specifically, research involving older individuals in nursing facilities, community settings, or receiving

in-home assistance was considered. Individuals necessitating oral health treatment, regardless of sex, race, socio-economic position, or complications, were included. Studies evaluating the use and usefulness of TD in these settings were considered. All forms of oral health services using health information technology were analyzed, including evaluation, diagnosis, assistance, consultation, schooling, and other applications in dentistry (Benoit et al., 2022). Interventions designed to evaluate the methods above, employing TD and conventional in-person dental appointments, were compared. The investigation's main objective was to compare TD's accuracy and efficacy with in-person dental consultations. The additional results evaluated the benefits and drawbacks of TD, including patient acceptance and the cost-effectiveness ratios.

2.3. Criteria for Qualification

Eligible investigations were (a) those released in English, (b) those submitted in peer-reviewed journals, (c) those published before 2025, and (d) clinical trials. Studies were eliminated if they were: (a) evaluations, opinions, comments, letters, book sections, studies on projected concepts and future scenarios (including procedures), and (b) theses.

2.4. Extracting Data

The study conducted the assessments autonomously. The first selection was conducted based on the titles or abstracts of the articles, with appropriate ones chosen for full-text evaluation. Excel sheets were created to evaluate each article. Data was gathered utilizing an accepted format that encompassed (a) authors' identities and release year, (b) the nation of origin of the research, (c) study kind, (d) study establishing (e.g., residence, belonging, aged-care capacity), (e) research objective, (f) type of dental care the supply via TD, (g) sample size, (h) average age and average deviation (when necessary), (i) primary outcomes of the one obtained article, (j) additional results of the obtained paper, (k) quality inspection rating, and (l) quality financial evaluation scores. The writers compared one another and validated the data based on the assembled worksheets. In instances of uncertainty about the research data, the two assessors reconciled discrepancies via conversation. A third examiner resolved inconsistencies in cases of uncertainty.

2.5. Evaluation of Quality

The scientific merit of the studies that comprised the review was assessed by two independent evaluators using the established technique. This methodology offers a quantitative assessment of the rigorousness of science. The comprehensive quality score, including outcomes and research design, indicates trust in the research results and their implications for future choices about TD. In summary, the robustness of the proof in TD research is determined by the study's execution and concept. Five distinct and vital areas are delineated for the study efficiency: (a) patient choice, (b) descriptions/specification of treatments, (c) formulation and evaluation of the research, (d) patient disposition, and (e) reported results.

Each area is assigned a score of 0, 1, or 2: 0 indicates the absence of pertinent data or insufficient detail, 1 signifies the provision of reasonable information with notable limits, and 2 denotes the lack of significant constraints in the data presented. In the research design, four distinct scores are designated: a score of 5 is awarded to big Randomized Controlled Trials (RCTs) with a minimum of 50 people per arm, a score of 3 to minor RCTs, a score of 2 to planned non-randomized studies, and a score of 1 to retrospectively comparative research. Based on the aggregate quality ratings, each research is categorized from A to E, with "A" representing studies of the greatest certainty and "E" representing the least trust. Specifically, groups A, B, C, D, and E represent overall quality scores of 11.5-15.0, 9.5-11.0, 7.5-9.0, 5.5-7.0, and 1-5.0, respectively.

3 RESULTS AND DISCUSSIONS

Thirteen articles were discovered via database searches using keyword permutations. Of the 13 publications, eight abstracts were evaluated for alignment with the research's objective, and full texts were obtained. Five research investigations were omitted due to duplication. After abstract evaluations, seven papers were chosen for further examination. A study was excluded due to its focus on adolescents. Out of the seven papers, six were evaluated for qualification. However, one study was eliminated for failing to fulfill the selection criteria (Figure 1).

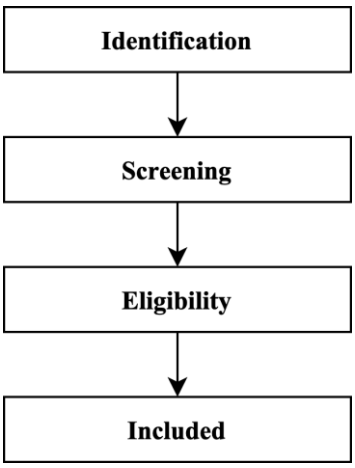

Figure 1: Workflow of the Research

The investigations included in this assessment were carried out in three distinct countries. A significant variability was seen across the included publications, indicating varied results. Two studies examined the feasibility and precision of TD for diagnosing dental disease, using conventional face-to-face examinations as the gold standard. Four studies focused on evaluating the opinions of clients and medical professionals about Telephone dentistry using surveys, direct observation of nurses, inquiries, and clinical inspection charts. Ultimately, three studies provided a cost assessment and an overview of TD in home elderly care institutions.

Full-text papers that satisfied the eligibility requirements are included. The document delineates (a) the identity of the authors and inclusion year, (b) the nation of origin of the research, (c) the study kind,

(d) the context of the research, (e) the goal of the research, (f) the kind of oral health the supply via TD, (g) the population sample size, (h) the average age with the variance (if necessary), (i) the main results of the one found article, and (j) the additional results of the obtained article.

Concerning the evaluation of the viability of TD for the screening of oral illnesses and disorders, as well as for formulating therapies, the study evaluated both virtual and conventional oral examinations. The intra-examiner contracts, assessed using the Kappa index, showed an outstanding concordance, Kappa = 0.84. The study evaluated the accuracy of the TD method in comparison to traditional in-person oral examinations. Identifications were categorized as Accurate Positive Tests (APT), incorrect diagnoses, and metrics such as accuracy (Ac), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV) were computed. Additional operational characteristic evaluations were conducted to assess the diagnostic effectiveness of TD. The virtual examination lasted 15 minutes, but the regular appointment lasted 25 minutes. The diagnostic findings for oral pathology indicated an Ac of 91.3%, a precision (Pr) of 93.2%, a PPV of 94.1%, and an NPV of 90.2% for TD. The area under the curve in a receiver's operating characteristics analysis was 0.89. The evaluation of chewing ability accuracy revealed an AC of 84.1%, a Pr of 83.2%, a PPV of 93.1%, and a NPV of 71.3% for TD. The sensitivity, Sp, NPV, and PPV for assessing the accuracy of dental prosthesis rehabilitation state were 86.2%, 91.2%, 79.2%, and 93.1%, respectively. TD demonstrated high sensitivity in identifying dental disorders in elderly individuals residing in residential aged care homes.

4 CONCLUSION

This systematic evaluation is the first analysis of the viability of TD for delivering dental care to elderly individuals, either in residential aged care institutions or receiving in-home help. In an aging society, integrating TD in senior housing and in-home support programs is a practical solution for managing oral care for those unable to access dental services. When mobility is discouraged for the most at-risk populations, minimizing non-essential appointments and prioritizing dental checkups is beneficial. Despite the limitations imposed by the lack of high-quality research, TD demonstrated comparable accuracy to conventional in-person dental exams, proved cost-effective, and received favorable acceptance from patients, their families, and caretakers. Rigorous research on TD and its context is essential to enhance the database and confirm the viability of digitalizing dental hygiene.

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