The objectives of this empirical study were to evaluate the quantitative and qualitative alterations experienced by community-dwelling elderly and their families when employing oral home telecare (a care service system based on interactive motion-picture transmission between households and healthcare providers). The subjects were four community-dwelling elderly in Kuriyama-cho, Hokkaido. The tutorial programs were designed to provide health information and education, as well as to enhance life skills related to exercise and communication. The programs were provided to the elderly through a new oral healthcare interactive learning system disseminated via an ISDN-based network. Quantitative and qualitative observation data on oral home telecare were collected by videophone and subsequently discussed. Functional independence in daily activities, communication skills, and social cognition, independence in oral care, and oral hygiene status all improved. Clients and their families were able to acquire broader knowledge relating to oral and general health, practical oral homecare skills, and social life skills. The use of this home telecare system as a “preventive home visit” and as a “living environmental tool” incorporating broad social supports could help improve the quality of life of clients and become part of a community oral healthcare service.

Key words: home telecare, oral care, self-care, community-dwelling elderly

Introduction

The importance of oral health to the elderly, a group with particular needs, has been widely recognized. Recent studies on the institutionalized elderly have highlighted professional oral care’s ability to reduce aspiration pneumonia and improve the functional level of activities in daily living (ADL). Although several field surveys have been conducted on oral health for the rapidly increasing population of the community-dwelling elderly, they have not yielded a concrete strategy. First, education on oral healthcare is required for both community health personnel and the community-dwelling elderly themselves. Second, improvements are necessary with respect to transportation barriers for the community-dwelling elderly, specifically with regard to their tendency to stay indoors, their lessening functional independence, and gaps in the oral healthcare delivery system between institution and home. In other words, community-based strategies for oral health are needed to address these issues and to improve quality of life for the community-dwelling elderly.

Thanks to recent advances in telecommunications, community-based fields such as medicine, welfare, education, and transportation have been rapidly changing in Japan. Meanwhile, many factors have affected the elderly’s ability to live at home while aging, including health, functional abilities, performance, and the amount, availability and quality of home care services. Home telecare employing a
videophone can eliminate a major transportation barrier for the community-dwelling elderly and provide a living environment that enhances their independence and social life skills. Moreover, it can meet their increasingly high demands and efficiently allocate limited social resources, namely healthcare personnel and time. Therefore, home telecare can be expected to improve quantitative and qualitative differences between the level of care that individual users receive.

Although the development of telecare has focused on the realm of medicine, the most noteworthy point of this study concerns the application of telecare to dentistry. First of all, learning efficiency is influenced not only by the learner’s age, but by the learner’s motivation, familiarity with the materials, cognitive and learning styles, the rate of information presentation, the amount and type of inter-and intratask interference, and the amount of practice put in. Therefore, the videophone system represents a highly effective potential learning tool for the elderly: not only does it focus the elderly’s attention through visual effects, it enhances their life skills and communication abilities. The objectives of this empirical study were to evaluate these quantitative and qualitative alterations of community-dwelling elderly in employing oral home telecare.

Methods

Subjects

Kuriyama-cho in Hokkaido, the geographical area of this study, is a snowy region with a population of 14,800 and over of 24.5% (compared to Japan’s national average of 17.3%). Kuriyama-cho has rapidly developed welfare projects to integrate community residents with the municipality. Since 1996, the municipality has financed a home healthcare support system research project between the municipal office and the homes of the elderly through ISDN videophone lines. This intervention study on oral telecare was conducted on four community-dwelling elderly. They were informed of the safety of the oral home telecare provided, the implementation of oral examinations, the records and evaluations of changes in their oral and general health and living environment, and the protection of their rights, and consented to participate in this study.

Establishment of a communication networks

An ISDN videophone line in a videophone therapy room at the university was added to existing lines in Kuriyama, and interactive communication networks were thereby established. The videophone therapy rooms at the university and the municipality were each equipped with an ISDN-line central control unit (WE001SE01, Fujitsu Co., LTD, Kawasaki, Japan), a desktop PC with videophone software (home support system, Fujitsu Co., LTD, Kawasaki, Japan), a main camera, and a microphone. Only at the university, a document camera with an optical manual zoom and focus control was installed as an educational tool. The homes of each client was equipped with an ISDN-line terminal control unit (WE001ZA01, Fujitsu Co., LTD, Kawasaki, Japan), a communication keyboard, a home television, a main camera mounted on a swivel and equipped with a zoom that could be operated by the former central control units, and an intra-oral camera (Crystal cam, GC Co., Tokyo, Japan). This new network enabled a three-pronged approach consisting of teleconferencing (exchanges between expert and healthcare personnel), tele-education (guidance of healthcare personnel, clients, and their families), and tutorial telecare.

Preliminary survey

A public health nurse visited the clients’ homes for pre-assessments and evaluated the clients’ medical history, family situation, living conditions, and daily activities. A university dentist (dental expert) and another public health nurse visited the clients’ homes, confirmed the pre-assessment and evaluated the medical conditions, nutritional status, and any functional or physical impairments (Table 1). The dental expert performed oral assessment on the basis of personal dental history, self-awareness of oral health, and oral examination according to WHO oral examination procedures (1997) (Table 2). Before and after oral home telecare, the dental expert conducted a semi-structured interview on the client’s awareness of oral care, habits and skills in oral care, willingness to undertake oral care, emotional support, and dietary habits via a videophone system.

Table 1. Characteristics of the clients

<table>
<thead>
<tr>
<th>Client No.</th>
<th>Sex</th>
<th>Age</th>
<th>Family status</th>
<th>Major diagnoses</th>
<th>Vision</th>
<th>Hearing</th>
<th>Speech</th>
<th>Cognitive motor</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>male</td>
<td>74</td>
<td>alone</td>
<td>Chronic renal</td>
<td>w</td>
<td>w</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>male</td>
<td>71</td>
<td>with spouse</td>
<td>Central infection</td>
<td>eyes, closed</td>
<td>right upper and lower limb, motor</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>male</td>
<td>69</td>
<td>with spouse</td>
<td>Cerebral hemorrhage</td>
<td>w</td>
<td>w</td>
<td>right upper and lower limb, right eard</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>male</td>
<td>79</td>
<td>with spouse</td>
<td>Central infection, Chronic bronchitis</td>
<td>w</td>
<td>w</td>
<td>left upper and lower limb, left eard</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

* Vision, hearing: within normal limits (w), abnormal (a), not particularly (.), moderate (+), severe (++).
videophone. The dental expert teleconferenced with healthcare personnel on problems, goals of the client and his family, and problem-oriented care planning based on these results. In addition, the dental expert kept in touch with the community dental practitioner should an emergency arise.

Field trial

Telecommunication in this study was carried out at an appointed half hour between 12:00 pm and 4:00 pm once a week, though in fact the frequency and duration depended on the physical condition of the client. In Case 1, telecommunication was carried out for 4 hours (6 times); in Case 2, for 5.4 hours (10 times); in Case 3, for 4.3 hours (11 times); and in Case 4, for 3.5 hours (11 times). Only in Case 2 was telecommunication conducted mainly with the family. The emergency notification system for the clients operated directly to the municipal office, and very little time was spent with the dental expert. Based on body language, body expression, and appearance, the dental expert was able to communicate with the clients and their families via videophone in a manner comparable to a face-to-face session. Tutorial items were divided into oral risk assessment with test kits, expert demonstration, text-based education, eating instructions, psychological motivation, and reducing the burden on the caregiver (Table 3). The following oral risk kits and care items were sent to the municipal office in advance, depending on the preliminary survey: plaque disclosing kit (Prospec, GC Co., Tokyo, Japan), rapid caries activity kit (Resazurin Disk Kit, Showa Yukuhin Kako Co., Ltd., Tokyo, Japan), salivary occult blood kit (Salivaster Kit, Showa Yukuhin Kako Co., Ltd., Tokyo, Japan), inter-dental brush, a sponge brush for cleaning palatal and mandibular mucosa and tongue dorsum (Toothette), mouthwash (Listerine), and collutorium (sodium azulenesulfonate). The dental expert provided tele-education on oral risk assessments to public health nurses and the public dental hygienist. By taking advantage of on-the-spot self-checks, color-changes of the risk kits were assessed first by the clients and their families, then by the dental expert via videophone and healthcare personnel right beside the client.

Evaluation

The evaluation findings and communication records were collected using an electronic filing system. Comparisons between previous and present evaluation findings, as well as image files, were made on a continuous basis. The following criteria were employed to evaluate alterations of the clients and their families.

1. Quantitative data in functional independence using the Functional Independence Measure (FIM) and oral care independence on brushing, denture wearing, and mouth rinsing (BDR), as means to evaluate reductions in the subject’s ability to perform at a home.

2. Quantitative data in oral and general health assessment including oral hygiene indicators such as mucosal-plaque score index (MPS index), tongue coating score (TS) and plaque control record (PCR), swallowing by repetitive saliva swallowing test (RSST), speaking, choking, coughing, and feeding.

3. Qualitative observational data in topics such as oral care knowledge, self-care skill, attitude, communication ability, social life, and qualitative interview data.

Results

1. Quantitative data in functional independence (Table 4, 5)
The ADL independence score in FIM improved in Clients 3 and 4, who exhibited stable physical condition. The communication and cognition independence score in FIM improved in all cases. BDR improved in the other three clients, except for Client 1 who was highly independent. No client became worse based on evaluation criteria for independence.

2. Quantitative data in oral and general health assessment (Table 6)

<table>
<thead>
<tr>
<th>Client No.</th>
<th>Before</th>
<th>After</th>
<th>Before</th>
<th>After</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>28</td>
<td>32</td>
<td>9</td>
<td>11</td>
<td>16</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 4. Change in functional independence Measurement (FIM): Before and after oral home telecare

Table 5. Change in Brushing, Denture wearing, Rinsing (BDR): Before and after oral home telecare

Table 6. Change in oral and general health assessment: Before and after oral home telecare

- MPS index and PCR improved in three dentate clients. TS improved in Client 4 who was treated with a sponge brush. Swallowing, choking, coughing, and feeding (food form, variety of food) improved in Client 4 with a history of aspiration pneumonia. Speaking improved in Clients 3 and 4, who exhibited stable physical condition. No client became worse, except with regard to the evaluation criterion for food intake.

3. Qualitative observational data and interview data

- Case 1 (client): With respect to knowledge, behavioral problems that had been overlooked in the preliminary survey were observed as opportunistic findings. He thus came to understand the damage to his oral cavity through counseling. The problem was that he had trimmed parts off his denture base and removed his denture clasps. With respect to skill, he was able to acquire knowledge-based oral care. In social life, the topic of oral home telecare provided an opportunity for him to chat and socialize with his neighbors. His fluctuation in physical condition could be more quickly assessed through the image of his feeding. In interviews, he said, “It was fascinating to attach the test kit using saliva to my arm and see how it changed to various colors on the spot.”

- Case 2 (client): With respect to attitude, he began to care for oral mucosa with a sponge brush after several telecare sessions, even though he had basically remained motionless with his eyes closed before.

- Case 2 (family): With respect to knowledge, her
attention was stimulated by risk kits and a dental model and she gained better comprehension. With respect to skills, she acquired inter-dental proximal cleaning skill through repeated practice, and knowledge-based skill to insert the client’s dentures safely. With respect to communication ability, increasing the number of opportunities for information transmission resulted in better and faster responses, and she appeared expressive in demeanor. With respect to social life, her depressive state due to exhausting healthcare obligations improved. She began to take a much more positive approach to daily life and accepted public nurses whom she had rejected before. In interviews, she said, “Though I didn’t really understand the text-based session, it was helpful to repeat and practice these new oral care skills after the tele-demonstration. I was relieved to talk about my feelings, though, as I was sensitive to interference from the videophone.”

• Case 3 (client): With respect to knowledge, his attention was stimulated by image information from the intra-oral camera and he gained better comprehension. With respect to skills, he learned how to grasp the brush and how to control stroke and power with the nondominant hand through repeated practice. With respect to attitude, he increased the amount of oral care to twice a day and continued to gargle every after meal. With respect to communication ability, he began to use body language and vocal expression, though he had depended on his family for his response due to motor aphasia. In interviews, he said, “I was amazed to see how clear and large my teeth and stains were when seen through an intra-oral camera”.

• Case 3 (family): With respect to knowledge, she could link up the contents of the textbook with her questions on the oral cavity, and she gained better comprehension. In interviews, she said, “Consultation skills were very important, since the interaction was via videophone and not face-to-face. If the expert carried on a one-sided conversation, we might have been less inclined to listen to specialist advice.”

• Case 4 (client): With respect to knowledge, his attention was stimulated by text and images. He used body language and gained better comprehension of the need for mechanical and chemical mucosal care for respiratory infection. With respect to skills, he, who had low ADL levels, learned how to implement mucosal care, following the interactive real-time motion and rhythms displayed. With respect to attitude, he began to exercise the muscles of his mouth by filling his cheeks with water, and continued to care for his oral mucosa with mouthwash after every meal, even though he had been unable to gurgle smoothly and required his oral cavity to be clean. With respect to communication ability, his vocal expression became smoother, though he had could express himself only by nodding due to heavy coughing and dysarthria. In interviews, he said, “It was indeed a pleasure to receive others praise for the oral care I managed by myself.”

• Case 4 (family): With respect to social life, she continued her efforts to provide higher-quality care by taking encouragement from his physical and mental recovery. For example, she took positive steps to control the humidity inside the room and had him use a vaporizer every morning and evening in order to prevent infection. She also improved devices for drinking and food preparation, although she had restricted his water and food intake to care for his aspiration. In interviews, she said, “My husband and I have been looking forward to communicating with the expert in front of the videophone and getting dressed. It is full of life.”

Discussion

The unique feature of this study was the use of information technology in an actual community, both to evaluate the quantitative and qualitative changes in community-dwelling elderly and their families, and to conduct a feasibility study on community oral healthcare services.

Analysis of the changes brought about by interventions in functional independence showed an improved ADL independence score in some clients, but not in others. The videophone tool maintained an appropriate distance between the expert on the one hand and clients and their families on the other. This observation from a safe distance suggested that the distance prevented clients from becoming too dependent on the expert, nurtured their independence, and finally served to close the gap between “performance” and “capacity.” Though elderly people with disabilities triggered by stroke tend to stay indoors and have disuse atrophy in physical and mental activity, this study
found that communication and social cognition independence scores improved in all clients. As Takano et al. reported, the improvements in functional independence could be attributed to semi-compelling transmission of information via a videophone, which expanded the range of living for the elderly and increased the scope of their physical and mental activities.

An analysis of the changes to their oral and general health shows that their oral hygiene status improved. This can be attributed to the multidimensional relationship between an educational approach and technical guidance. The intervention period was considered to be insufficient to obtain oral functional improvements in other clients except for the aspiration pneumonia high-risk client. Oral and general assessments were based on visual evaluations via a videophone image, and further study for these evaluations will be necessary.

Analysis of the qualitative observations and interviews shows that broader knowledge relating to oral and general health, was acquired, along with practical oral homecare skills and other social life skills.

1) Client and family: Observations suggested that immediate color-coded changes in oral risk kits stimulated their attention and were far more effective than indications using words and symbols (such as plus or minus signs) in increasing one’s understanding of oral status. Improvements in oral homecare skills were attributed to the educational approach represented by demonstrations and repeated practice, as compared to teeth cleaning by conventional domiciliary dental services. Early reduction of coughing was attributed to improvements in daily mechanical and chemical oral mucosal cleaning and living environment and thus contributed to a restoration of strength and improvement of QOL including diet.

2) Client: Self-checks via an intra-oral camera contributed to the client’s recognition of poor oral status on his paralyzed side and to an improvement in self-care skills. Observation of his willingness to improve suggested that oral home telecare programs were useful in increasing internal Health Locus Control, and that health maintenance is dependent on self-help efforts. Moreover, observations and interviews suggested that finding what actions to perform in the living environment is vital to regenerating the self-esteem of clients with disuse syndrome.

3) Family: Technical and moral support in the form of the client’s trusted peer counselor contributed to his motivation to learn and improve his communication skills. Moreover, it is striking that this videophone tutorial was actively incorporated into her daily life on a regular time schedule, and then served as a kind of “life space” counseling. (My use of the term “life space” intentionally echoes the technical term “life space interview” as it is used in social work.)

The number of elderly requiring daily personal assistance is expected to grow to 1.9 million by the year 2010. There is an urgent need to reconstruct service delivery from institutional care to home and community care, due to shortening periods of hospitalization and changes in awareness of treatment emphasizing the patient’s QOL. Furthermore, in urban areas, the proportion of persons aged 65 and over will increase by about 50% over the coming decade. Accordingly, I would like to emphasize that the community-based home telecare system represents a notably more stable and efficient home healthcare service and is not merely for patients whose access to care is limited for geographic reasons.

Telecare’s role in liberating caregivers from the traditional constraints of space and time has already been discussed. Home telecare can enable health professionals to make a comprehensive assessment of physical, psychosocial, and environmental factors for homebound elderly and to advise the high-risk elderly on health and life issues, thus assuming many of the functions of the Euramerican “preventive home visit.” Moreover, telecare can be expected to provide a wider social support network (e.g., in the form of volunteers in this region) that can assist in lifelong learning and group activities as well as in preventing dementia and language training, which is a “life environmental tool.” The degree to which such interactions affect dentist’s decision-making and client satisfaction needs to be investigated more fully.

Finally, the spread of oral home healthcare is highly dependent on the ability to secure a healthcare provider, well-trained personnel with good communication skills, and computer-literate technological supporters. Although ordinary telephone lines were used in this study, broadband and optical communications already offer low-priced and high-definition images due to rapid infrastructure development. Consequently, the application of oral home telecare could be expanded as part of efficient and comprehensive welfare projects by municipality, customer management by family dentists, or home health maintenance service programs developed by telecommunication providers.
Acknowledgements

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References