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ABSTRACT

To investigate the extent to which a relationship may exist between nurses' own oral hygiene and their commitment and capability of following instructions for tooth brushing with conventional and triple-headed toothbrushes, to cerebral palsy (CP) children. The study included 43 individuals with CP and their 44 nurses. A structured questionnaire was designed to assess I. Demographic characteristics of the nurses II. Nurses' knowledge and maintenance of their own oral-hygiene and that of their CP patients. Nurses' ability to follow instruction for tooth-brushing was evaluated and scored using the TB-PS-I/Ashkenazi index following the first brushing, as well as on a recall visit one month later. More nurses (72.7%) reported routine tooth-brushing in the morning than in the evening (40.9%). Most nurses (73%) reported not flossing their teeth at all, and more than half reported visiting their dentist only when they suffer pain. A positive correlation was found between the nurses' knowledge of preventive oral measures and their compliance with their own oral hygiene and with that of their CP patients. Similarly, a positive correlation was found between nurses' receiving previous instruction for correct oral hygiene and their maintenance of their patients' oral hygiene. Institutions for CP patients should disseminate information on oral hygiene to staff, as a means of increasing their maintenance of their patients' oral health.

KEY WORDS: dental hygiene, dental plaque, disabilities, healthcare providers, periodontal disease

The relationship between nurses' oral hygiene and the mouth care of their patients

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Introduction

Cerebral palsy (CP) is characterized by palsy, muscle weakness, and uncontrolled, unpredictable, uncoordinated, and unmanageable movements. Spastic patients may also suffer from uncontrolled oral and perioral muscle action, which cause difficulties in mastication and swallowing, and contribute to increased accumulation of food debris in the oral cavity. Moreover, the consumption by some, of anticonvulsant medications (such as Phenitoin) increase gingival overgrowth, especially in the presence of inadequate oral hygiene.[1] Several clinical studies found individuals with CP to suffer more frequently from high bacterial plaque accumulation, gingivitis, and gingival overgrowth than healthy children.[2-5]

Many CP patients lack the ability to maintain their own oral hygiene.[1,5,6] Transferring the responsibility of tooth brushing to another person has been shown to increase effectiveness.[1,5,7] Nevertheless, tooth brushing of children with CP by a nurse remains a complicated task. Difficulties include seating the child, the child's uncontrolled movement of the tongue, increased gag reflex, and the tendency to firmly close the jaws, as well as the presence of dyskinetic movements and difficulty in spitting, make it difficult for the nurse to insert the toothbrush into the mouth and operate it. Speech problems often hinder communication; moreover, many nurses in institutions for the handicapped are new immigrants who do not speak the native language fluently, which exacerbates communication problems.

Several studies compared the effectiveness of toothbrushes of different designs in reducing dental plaque and gingivitis. Three separate studies found that the manual triple-headed toothbrush was superior to the single-headed toothbrush in reducing bacterial plaque, gingival and bleeding indices in normal and handicapped children, aged 4–18 years old.[6-8] Moreover, Telishevesky *et al*. found that the triple headed toothbrush promotes more consistent tooth brushing by parents than does the single-headed toothbrush.[9] Sauvetre *et al*. reported comparable effectiveness in reducing bacterial plaque following tooth brushing with a conventional, electric or

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triple-headed toothbrush in CP children, and concluded that even brushing with a triple-headed toothbrush required minimal skill that the handicapped participants were evidently lacking.[10] Similarly, two separate studies concluded that electric toothbrush is not superior to a manual toothbrush, when used in mentally handicapped adults.[11,12]

Nevertheless, the provision of proper mouth care to CP patients requires high motivation and commitment of the nurses. Gil-Montoya *et al*. investigated the awareness and commitment of nurses to maintain oral hygiene of adult institutionalized patients in Spain. Dental plaque was detected in 90% of the patients, and gingivitis in more than half, even though 97% of the nurses reported receiving instruction for maintaining oral hygiene.[10] The main conclusion was that most of the nurses did not consider oral hygiene an important task.

One factor that may predict the motivation and commitment of nurses in providing effective and regular oral hygiene to their patients is their commitment to their own oral hygiene. Zadik *et al*. studied compliance of health providers regarding their own oral hygiene. For nurses, the frequency of tooth brushing and flossing was relatively high, but periodic examinations and scaling low.[13]

The aim of the present study was to investigate an association between nurses' own oral hygiene and their commitment to, and capability of follow instruction for tooth brushing with conventional and triple-headed toothbrushes, to cerebral-palsy children.

Methods

Questionnaire

A structured questionnaire was designed to assess I. The demographic characteristics of the nurses (age, gender, years in occupation, and years of education); II. Their knowledge of, and commitment to, maintaining good oral hygiene for themselves and for their CP patients; and III. Problems nurses faced when brushing their patients' teeth. The questionnaire was designed by an experienced certified pediatric dentist (MA) and by two graduate students (MY, YY). Some questions were obtained from previous publications that evaluated patient compliance with preventive measures.[15]

For analysis, the questions in part II of the questionnaire were divided into several groups: knowledge of preventive measures (questions number 12–18; Do you believe that fluoridated toothpaste can prevent dental caries (cavities)?; Do you believe using toothpaste is important for prevention of dental disease?; Do you believe that tooth brushing is important for prevention of periodontal disease?; Do you believe that flossing is important for prevention of periodontal disease? Do you believe that flossing is important for prevention of dental caries (cavities)?; How often do you believe your CP patients teeth should be brushed?; What is the most prevalent disease in the oral cavity of CP patients): commitment to maintaining personal oral hygiene (questions number 1–7, 10–11; How many days a week do you brush your teeth regularly in the morning?, in the evening?, What is the fluoride concentration in your toothpaste?; How do you choose your toothpaste?; How frequently do you replace your toothbrush?; Do you floss or clean your teeth with tooth pick?; How frequently do you visit your dentist?; Do you suffer from bleeding during tooth brushing or during eating an apple?; Have you been treated by extraction of teeth because of dental caries or periodontal disease during the period of your employment in this institution?), commitment to maintaining good oral hygiene for their CP patients (questions number 20–25; Did you ever not brush a patient's teeth because of workload?; Are there patients whose teeth you never brush because of lack of cooperation?; Do you floss your patients' teeth on a regular basis?; Do you clean your patient's tongue on a regular basis?; When do you replace your patients' toothbrush? How do you choose the toothpaste for your patients?), previous instruction in their own tooth brushing (questions number 8–9; Did you ever receive instruction from your dentist or hygienist on correct tooth brushing?; Did you ever received instruction from your dentist or hygienist on how to floss your teeth?) and previous instruction in brushing the teeth of CP patients (question number 19; Did you receive instruction on how to correctly brush your CP patient' teeth?).The responses were scored on a 0–3 point scale. 0 = low level, 3 = optimal answer. Some answers to a question received the same score.

Study population

The study included 43 individuals with CP and their 44 nurses. The individuals with CP were 28 (65%) males and 15 (35%) females; aged 4–31 (mean age was 11.65, median 11 years). Of them, 24 (55.8%) were institutionalized and 19 were externs, who resided in the institute until late afternoon and slept at home.

The nurses were all women aged 19–61 years (mean age 42.04 ± 13.34 years) who worked in the institution for 0.4–20 years (mean 8 years). Their mean number of years of education was 13.5 (range 12–17). All were right-handed. Two refused to participate, but agreed to receive instruction in tooth brushing.

The Ethics Committee of Tel Aviv University and the Israel Ministries of Education and Health approved the study; written informed consent was obtained from the parents of the participants with CP and from the nurses.

Study design

This is a prospective study. At the start, the nurses were asked to fill the questionnaire. Immediately afterwards, the nurses and their residents were divided into two groups. The nurses of group A (n = 26) were first instructed in brushing teeth using a manual single-headed toothbrush (Paro M27, Paro, Switzerland; Figure 1) for the first month and a manual triple-headed toothbrush (Dr. Barman's Superbrush, DENTACO, AS, Haukeland, Norway) for the second month; and those of group B (n = 27), were instructed in the use of the same toothbrushes, in opposite order.

Two dentists (YY, MY) individually instructed the nurses in brushing the patients' teeth. Instruction included an explanation of the purpose of brushing

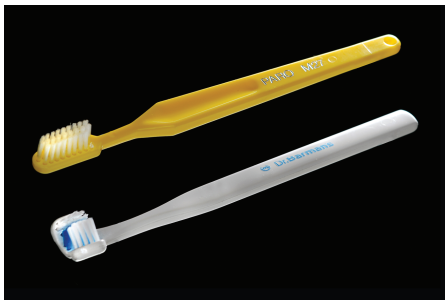


Figure 1. Types of toothbrushes evaluated: single-headed toothbrush (M-27, Paro Switzerland) and triple-headed (Dr. Barman, Superbrush, Dentaco AS, Norway).

and a demonstration of the technique on a plastic model and on patients' teeth. Immediately after demonstration, the nurses brushed the residents' teeth under the supervision of one of the dentists. Tooth brushing performance was evaluated as described below. In case of nonoptimal performance, further instruction was provided until correct tooth brushing was achieved. Nurses were instructed to brush residents' teeth twice daily, morning and evening, immediately after meals.

Instruction for brushing with the single-headed toothbrush was according to the horizontal scrub technique,[8,9,14] i.e., to brush the buccal aspect in each arch in five segments (anterior, two canines, and two posterior segments) and the lingual/palatal aspect in three segments (anterior and two posterior segments), to place the toothbrush partially on the gingiva and partially on the teeth, and to perform 10 back and forth brushing strokes on each segment.

Instruction for brushing with the triple-headed toothbrush entailed brushing each arch in 5 separate segments (anterior, two canines, and two posterior segments), to place the toothbrush on the occlusal surfaces, and to perform about 10 back and forth brushing strokes on each segment.[8,9]

Immediately after receiving instruction, and after each month of tooth brushing with each type of toothbrush, the nurses' tooth brushing performance was re-evaluated. The toothbrushes and toothpaste (Sensodyne Digimon, kindly donated by Glaxosmithkline Corp. Brentford, England, 1100 ppm F^-) were provided free of charge.

To ensure uniformity of instruction, the two examining dentists received guidelines written by one of the authors. On the first day of the study, immediately after instructing the nurses on correct brushing of residents' teeth, reliability of the Tooth Brushing Performance Skill Index (TB-PS-I), described below, was assessed, while the nurses brushed the teeth of eight residents. The inter-rater agreement (MA, MY, YY) was 93–95%. These scores from the first day were not included in the study.

Tooth brushing performance skill index (TB-PS-I/Ashkenazi index)[8,9]

Nurses' ability to follow tooth brushing instructions was evaluated using the tooth brushing performance skill index (TB-PS-I/Ashkenazi index) as described previously, according to two criteria: correct placement of the toothbrush on each segment (even once) ("reach"), and the performance of a sufficient number of horizontal strokes[8-10] in each segment ("stay").[8,9]

Statistical analysis

Descriptive analysis was performed on patient responses to the questionnaire. The Chi-square test and Fisher's exact test were used to evaluate relationships between two variables. TB-PS-I between data after brushing with the single- and triple-headed toothbrushes were analyzed using the paired *t*-test (two-tailed). The level of significance was set at 5%.

Results

Maintaining personal oral hygiene

Oral hygiene

More nurses reported routine tooth brushing in the morning than in the evening (72.7% vs. 40.9%). About 20% reported brushing their teeth in the evening three or fewer times a week. Most nurses reported choosing toothpaste according to their dentists' recommendation, and using toothpaste with the optimal fluoride concentration, 1,250–1,450 ppm. Yet, 9% reported choosing toothpaste according to its price, and the same percentage reported using toothpaste with fluoride concentration of only 250–500 ppm. Most (86.4%) of the nurses reported replacing their toothbrush at least once in 8 months, or according to fiber configuration. Most (73%) reported not flossing their teeth at all, or using floss only to remove impacted food. Only 5% reported flossing their teeth every 1–2 days. Nevertheless, only 25% reported gingival bleeding during tooth brushing.

Dental check-ups and treatment

More than half of the nurses reported visiting their dentist only when they suffer pain. For 9%, the frequency of visits was every 3 or more years. During their employment in the institution, 18% had at least one tooth extracted as treatment for caries or periodontal disease.

Knowledge of oral disease prevention

Knowledge of maintenance of oral hygiene

More than half of the nurses believed that their CP patients' teeth should be brushed twice daily, and 88.6% were aware that tooth brushing is important for prevention of periodontal disease. However, only 56.8% knew that toothpaste is very important for preventing caries. More than half (54.6%) thought flossing is important for the prevention of periodontal disease, 63.7% thought it important for the prevention of caries, and 45.5% thought flossing is only moderately or not important at all for prevention of periodontal disease.

Only 38.6% knew that periodontal disease is the most prevalent disease in the oral cavity of CP patients. About 22.7% thought caries is the most prevalent disease in CP patients and 15.9% believed that CP patients' susceptibility to oral diseases is comparable to that of the healthy population.

Receiving previous tooth brushing instruction

Among the nurses, 29.5% reported not receiving instruction for correct brushing

Table 1. Problems associated with the tooth brushing of CP patients.

Type of problem	Response % (number)		
	A great problem	A mild problem	Not a problem
Increased gag reflex	9.1%	40.9%	50%
	(4)	(18)	(22)
Inability to open the mouth during tooth brushing	54.5%	29.5%	15.9%
	(24)	(13)	(7)
Uncontrolled tongue movements	11.4%	34.1%	54.5%
	(5)	(15)	(24)
Uncontrolled head movements	35.4%	27.3%	36.4%
	(16)	(12)	(16)
	Agree	Partially agree	Do not agree
It is only possible to brush the anterior teeth of CP patients.	65.9%	9.1%	25%
	(29)	(4)	(11)
The complete questionnaire is available on request from the authors.			

of their own teeth, and 63.6% did not receive instruction for flossing. Only 25% received instruction for tooth brushing more than once in their life. Moreover, 43.2% never received instruction for brushing their patients' teeth, and 34% received instruction only once.

Commitment of nurses to their CP patients' oral health

Most of the nurses (77.3%) reported never missing brushing a patient's teeth because of workload, and only one nurse reported missing brushing a patient's teeth more than once for this reason. However, 65.9% believed that it is possible to brush only the front teeth of their CP patients (Table 1). Nevertheless, 91% reported always trying to brush their patients' teeth, even if the patients do not cooperate.

Among the nurses, 40.9% reported regularly brushing their patients' tongue, yet 9% reported not cleaning the tongue because of the difficulty in doing so, and 32% because they were not instructed to do so. In contrast, all the nurses reported not flossing their patients' teeth, 18% because of the difficulty, and 82% because they had never been instructed to do so.

About one third of the nurses reported replacing their patients' toothbrushes at least once in 8 months or according to the brushes' fiber configuration. More than half the nurses reported that the frequency of replacement is determined by the institution or by the patients' parents.

Problems associated with brushing CP patients' teeth

Most (90%) of the nurses believe that CP patients do not suffer from increased gag reflex during tooth brushing and do not move their tongue excessively during tooth brushing. However, only 16% believe that their patients can open their mouth enough to brush their teeth correctly (Table 1).

Correlations between knowledge of preventive measures and demographic data

Positive correlations were found between nurses' knowledge of preventive oral measures and their seniority (R = 0.432, p = .003), their compliance to self oral hygiene (R = 0.372, p = .013), their ever receiving instruction for brushing their own teeth (R = 0.288, p = .058) or those of their CP patients (R = 0.303, p = .046), and their commitment to maintaining good oral hygiene of their CP patients (R = 0.314, p = .038). Similarly, a positive statistical correlation was found between receiving previous instruction for correct oral hygiene and commitment to maintaining good oral hygiene for their CP patients (R = 0.345, p = .022).

Variables correlating with nurses' ability to correctly follow instruction for tooth brushing (TB-PS-I score)

At baseline, following instructions, the percentage of nurses who brushed the patients' teeth properly based on TB-PS-I was similar in both groups (TB-PS-I for the conventional and the triple-headed toothbrush was 92.7% and 92.2%, respectively). However, at one month assessment, the TB-PS-I for the single-headed group was decreased by about 10% (p < .001). The main deterioration was observed in the "stay" component (20.2%, p < .001). In contrast, in the triple-headed group, the different components of TB-PS-I scores remained the same (p = not significant).

No correlations were found between TB-PS-I scores when using the conventional or triple-headed toothbrush, at baseline or at one month assessment, and between age or seniority of the nurses. The only exception was a negative correlation at baseline between seniority of the nurses and the "stay component" of the TB-PS-I score for the triple-headed toothbrush (R = –0.32, p = .034). In contrast, a positive correlation was found between knowledge and baseline TB-PS-I score in the conventional toothbrush group: (R = 0.424, p = .004), as well as between "reach" and "stay" components (R = 0.349, p = .02 and R = 0.443, p = .003, respectively). No such correlations were found in the triple-headed toothbrush group.

Discussion

In this study we investigated the personal oral habits of nurses working with young institutionalized CP patients. The frequency of their tooth brushing

was less than optimal, and the frequency of flossing and periodic dental check-ups very low. Yet, the findings are not very different from those of previously published data, such as those of oral health among children attending recall appointments in Israel, among medical students in Kuwait, or among students in Bolonia.[13,15-17] Similarly, nurses' awareness to choose toothpaste according to its optimal fluoride content concurs with previous reports.[17,18]

A positive correlation was found between nurses' personal oral hygiene habits and their commitment to maintain good oral hygiene for their patients. This suggests that raising their knowledge and awareness to their own oral hygiene habits may increase their commitment to the oral hygiene of their CP patients. This is reinforced by the positive correlations observed between nurses' commitment to maintaining good oral hygiene for their CP patents and both their knowledge of preventive measures and their receiving instruction for correct tooth brushing. Our findings concur with those of Nicolaci *et al*.[19] who reported that education about oral hygiene for healthcare providers increased their knowledge and the degree by which their patients' oral hygiene improved. Similarly, Frenkel *et al*.[20] found that oral care education programs improved the oral care knowledge and attitude of nursing home caregivers; their improved knowledge and attitude was positively correlated with improved delivery of oral health care to their clients.

In this study the information regarding the nurses' personal oral hygiene habits and their commitment to maintain good oral hygiene for their patients was achieved by self reports. The validity of information regarding oral health obtained by self report is in controversy. Taylor and Borgnakke concluded that self-report may be valid for surveillance of oral health-related self-care and periodontal disease burden and trends in the American population, in lieu of more costly clinical periodontal examinations.[21] In contrast, Fukuda and Shinsho concluded that the accuracy of self-reported health examination is poor and the frequency of accurate self-reporting is limited to 49.4%.[22] Accordingly, the real frequency in the present study of tooth brushing and flossing may even be lower.

We evaluated nurses' capability of correctly following instructions for brushing their patients' teeth with the Ashkenazi TB-PS-I. TB-PS-I scores for nurses using a conventional toothbrush correlated positively with their knowledge of preventive oral measures. However, this correlation (between TB-PS-I and knowledge) was observed only immediately after instruction. A month later, no correlation was found between tooth brushing with either toothbrush type investigated and nurses' knowledge of preventive oral measures. The decrease in TB-PS-I scores observed after only one month concurs with findings of Telishevesky *et al*. who showed deteriorated brushing with a conventional toothbrush following one month of instruction,[9] and with Blinkhorn *et al*.[23] who showed tooth brushing to be on a very low level of priority, even among mothers of children with high risk for caries. The deterioration in tooth brushing, especially in an institution, may also be attributed to work exhaustion. Institutionalized patients are difficult to manage and most do not cooperate. This assumption is supported by Schaefer and Moos's evaluation of 405 health providers.[24] They found difficult conditions in nursing to induce depression and distress among workers, and to reduce work efficiency.

The fact that nurses' ability to brush their patients' teeth using the triple-headed toothbrush was not correlated with their knowledge of oral hygiene, may be attributed to the minimal coordination and time required for correct brushing when using this toothbrush, or to the fact that they had never been instructed in its use. Nevertheless, our findings support the provision of periodic oral hygiene instruction, especially for health providers in institutions for handicapped children. Indeed, Bellini[25] concluded that the optimal frequency of instruction by a dentist or hygienist in good oral hygiene is once in 1–3 months. Although Ower[26] did not find the number of instruction sessions to be associated with reduced plaque level, he still recommended frequent refreshing of instructions. Another approach to improving nurses' performance in maintaining their patients' oral hygiene involves positive and negative rewarding.[27]

In this study we found nurses' seniority to correlate positively with their knowledge of maintaining good oral hygiene. This contrasts to age and years of education, which were not correlated with knowledge. In our study, senior nurses may have had more opportunities to be involved in oral hygiene instruction sessions organized by the institute where they were employed. Formal education, on the other hand, generally does not include courses in oral hygiene. This further highlights the importance of organizing and providing lectures, seminars and personal instruction to the personnel of institutions for handicapped. Our findings contrast to those of Frenkel *et al*.[20] who found age to be positively correlated with nurses' knowledge, and no correlation between seniority and knowledge. Further, Frenkel *et al*. found that nurses aged 46 and above performed tasks relating to maintenance of oral hygiene at the lowest level. A reason for the discrepancy with the present study may be that the older nurses at the institution we investigated were mainly very religious women who did not watch television or read secular newspapers.

In conclusion, a positive correlation was found between nurses' knowledge of preventive oral measures and their commitment to oral hygiene for themselves and their CP patients. Periodic oral hygiene instructions should be provided to health care providers to increase their commitment to their patients' oral hygiene.

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