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Improving toothbrushing behaviour in an institution for the disabled in Lisbon, Portugal

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Abstract: The oral health of disabled persons is strongly associated with oral hygiene practices. However, many difficulties limit them from removing dental biofilms (plaque). *Purpose:* This pilot study evaluates changes in toothbrushing capability among 135 disabled individuals enrolled in an institution for the disabled. *Methods:* Direct observation of toothbrushing behaviour of the disabled was used to recommend changes required in daily toothbrushing programme. The simplified Debris Index (DI-S) was used to compare plaque removal outcomes over a 3-month period. *Results:* At baseline, of the 135 participants, 114 completed a routine toothbrushing procedure and 10 (8.8%) of them brushed all tooth surfaces. At the end of the study, 52 (48.6%) brushed all tooth surfaces. The mean difference between the initial and final DI-S was 0.62 ($P < 0.01$). *Conclusion:* Toothbrushing was not a common procedure at this institution. This study shows that it is possible to implement daily oral hygiene maintenance in disabled individuals. Furthermore, most participants will adopt more efficient toothbrushing behaviour when monitored daily.

Key words: dental health education; disabled; oral health promotion; plaque control; toothbrushing

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Introduction

In Portugal, almost 10% of the total population has one or more disabling conditions (1). It is well known that these conditions limit capabilities to perform several daily living activities (2). In spite of this situation, little attention is paid to the oral health needs of the disabled. The disabled face many challenges including oral health problems. While oral diseases of the

disabled are similar to those of non-disabled, there are additional burdens found in this population. Most disabled have less than average manual dexterity, less motivation and short attention span. They depend on others for personal hygiene and feeding. They usually eat soft foods and have low masticatory efficiency to control dental plaque, which is essential for maintaining positive oral health (3).

Studies suggest that disabled individuals have more dental caries and higher numbers of lost teeth and point out that the predominant treatment need is to control the periodontal diseases. Furthermore, they suggest that prevention and control of periodontal pathology rely on one's own control of dental plaque (4–7). This is a severe challenge for most disabled persons.

Toothbrushing is the simplest and most effective method to reduce dental plaque. Although toothbrushing can be a difficult task to perform correctly, many disabled individuals can do it by themselves with proper training and reinforcement (8).

The development of oral health strategies should be given priority to prevent oral disease and maintain oral health as it improves appearance and self-esteem, provides better social opportunities and brings about a higher quality of life.

In a community setting, oral hygiene strategies aim to build awareness for the need of daily dental plaque control as well as regarding the provision of dental calculus removal by professionals, as and when needed (4, 6, 8, 9).

Caregivers can supervise and assist in oral hygiene practices of disabled people because inadequate and inconsistent supervision of daily oral hygiene practices can contribute to individuals' poor oral hygiene (10). As a principal component of their role, they help bring about behavioural changes through education as well as skill development. Successful change can be achieved when disabled persons, their family and caregivers understand reasons for the need to change and the consequences of poor oral hygiene.

Kay and Locker (11) found that improved reductions in dental plaque levels are achieved if there are short follow-up periods. The evidence from their study suggests that simple oral hygiene instructions can lead to short-term changes in the behaviour of an individual. Their meta-analysis reported an overall plaque reduction among all teeth and teeth surfaces.

The aim of this study was to determine the efficacy of an institutionalized plaque control programme among disabled residents in Lisbon, Portugal as well as to report differences among the disabled with respect to age, gender, type of disability and type of tooth.

Methods

Study population

The study was conducted in Crinabel, an institution for the disabled located in Lisbon, Portugal. One hundred and thirty-five residents aged 12–46 years with a mean age of 23.81 years participated in this study. Participants presented with a variety of conditions (Table 1). Most of them were mentally disabled with trisomy 21 and had learning difficulties. Sixty-seven subjects were females and 68 were males.

Of the 135 individuals, 51 (37.8%) had some difficulty in establishing effective communication. Three (2.6%) were not able to communicate at all. Eighteen subjects needed help from others for daily oral hygiene maintenance.

Programme activities

An oral health programme was conducted to establish daily toothbrushing routine at the institution after lunch, to teach the caregivers about oral health, and to sensitize study participants, caregivers and parents to the importance of good oral dietary habits and oral hygiene practices.

The activities were carried out during a 3-month period, from September to December 2006. All the subjects received training in toothbrushing once a week, caregivers received weekly in-service education and parents had only one session at the end of the programme. The educational topics focused on oral diseases and their prevention, and on the use of adaptive devices and techniques for plaque control.

The dental hygienists and caregivers assisted the residents in creating visual aids on cariogenic foods, dental caries and periodontal diseases. To remind everyone of the prescribed procedure, colourful posters showing photographs of subjects performing toothbrushing were posted in all bathrooms. We tried to motivate the more severely handicapped by involving them in activities like preparing paper cuts on oral hygiene themes and colourful materials to create posters, mobiles and games.

Table 1. **Distribution of disability condition in the study population**

Handicap condition	Number of subjects (n = 135)
Mentally disabled	35
Cerebral palsy	7
Trisomy 21	17
Autism	8
Learning difficulties	59
Other pathologies	9

To teach the caregivers on how to perform toothbrushing and to improve their oral self-care, we gave in-service education using adaptive aids and practical demonstrations. The parents participated in a meeting at the end of the 3-month study regarding oral diseases and prevention, so that they could help their children to perform oral hygiene practices.

Review of human subjects and consent

The study protocol was reviewed and accepted by the director of the Disabled Institution in July 2006, and an initial contact letter about the programme was sent to all parents or guardians to obtain consent. All but one parent/guardian gave informed consent for their disabled family member to participate. Assent from the study participants was obtained whenever the individual was capable of responding.

Plaque assessment

Plaque assessment was performed at the beginning and at the end of the 3-month study using the simplified Debris Index (DI-S) (12).

Toothbrushing skill assessment

A toothbrushing task analysis data sheet was used to collect data on the ability of the individual and/or caregiver to complete various steps in the process of toothbrushing. After observation of brushed areas, we assigned a number as follows:

1 Brushed facial surfaces only.
2 Brushed facial and occlusal surfaces only or
3 Brushed facial, occlusal and oral surfaces.

Manual dexterity and hardness or vigour of movements were registered as 'yes' or 'no'. To stimulate the autonomy in toothbrushing, this procedure was supervised individually by a hygienist once a week, in the bathroom after lunch. Alterations and reinforcement of the technique were performed as needed.

The individuals were instructed to brush their teeth using the Bass technique adapted to personal dexterity. The dental hygienist who supervised the technique made a record of each individual to register the surfaces brushed at each time so that the next session could be monitored for the evolution of the technique.

Statistical methods

Data were analysed using the statistical software SPSS, Windows version 13.0. To compare the mean DI-S differences between initial and final evaluations, we used paired-samples *t*-test. To analyse differences in mean DI-S between genders, an independent-sample *t*-test was used. One-way ANOVA was used to evaluate the differences in plaque index between age groups. The differences between baseline and final DI-S by handicap condition were analysed using Friedman test and the mean DI-S differences between groups were analysed by Kruskal–Wallis test. A Pearson's correlation test was used to evaluate the correlation between baseline and final DI-S for each individual tooth (13).

Results

Toothbrushing skill assessment

One hundred and fourteen (84.4%) of the 135 individuals were able to place the brush in the mouth and made some movements even though without any sequence or method. The rest of the individuals did not know what to do with the brush. Of the individuals who were able to place the toothbrush in the mouth, 60 (52.6%) had some manual dexterity to perform the technique, but 16 (26.7%) used excessive pressure.

The final examination of toothbrushing was made in 107 individuals. The comparison of surfaces brushed at baseline and at follow-up revealed that 8.8% of the individuals brush all surfaces initially compared with 48.6% in the final examination. The changes observed are shown in Fig. 1.

Plaque assessment

Of the 135 subjects who participated in the programme, 114 (84.4%) were assessed using the DI-S. The non-participants (15.6%) were unwilling to cooperate with the procedure. The final DI-S evaluation was carried out in 97 (85.1%) of the initial 114 subjects. The remaining 17 were not available at the

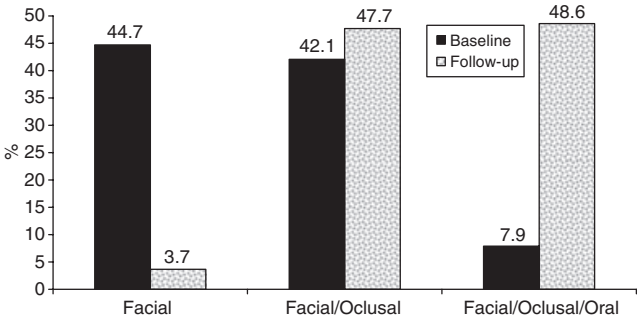

Fig. 1. Differences of areas brushed between baseline and follow-up.

time of final assessment. They were practising professional integrity in the work environment.

The mean overall difference between initial DI-S (1.86 ± 0.66) and final DI-S (1.24 ± 0.69) was statistically significant at the 0.001 level. Initial and final intervention DI-S mean individual values show that 11 subjects (11.3%) increase, 78 (80.4%) decrease and eight (8.3%) maintained DI-S values.

The analysis of DI-S by age group (Table 2) shows that all age groups on the first evaluation present at least one-third of the tooth surface with plaque, the oldest group being the one with the highest baseline index. However, this group shows the greatest decrease in absolute value.

The comparison of the mean DI-S values by gender (Table 3) shows that the female group had a higher plaque index at both evaluations, although the absolute difference between initial evaluation and final evaluation was higher.

The analysis of the mean DI-S difference between initial and final evaluation (Table 4) shows that there was a reduction for all groups. These reductions were statistically significant for mental disabled, Trisomy 21 and learning difficulty groups.

Table 2. **Comparison of DI-S scores by age groups**

Age group (*n*)	Baseline*	Follow-up†	*P*-value
<20 (35)	1.895	1.317	<0.000
20–29 (40)	1.784	1.232	<0.000
≥30 (22)	1.93	1.128	<0.000

*ANOVA ($F = 1.683$; $P = 0.151$).
†ANOVA ($F = 1.036$; $P = 0.359$).

Table 3. **Comparison of baseline and follow-up DI-S scores by gender**

Gender (*n*)	Baseline*	Follow-up†	*P*-value
Female (51)	1.92 (±0.67)	1.27 (±0.72)	<0.000
Male (46)	1.79 (±0.63)	1.21 (±0.67)	<0.001

*Independent *t*-test ($P = 0.361$)
†Independent *t*-test($P = 0.386$).

Table 4. **Comparison of baseline and follow-up DI-S scores by disabling condition**

Disability (*n*)	Baseline*	Follow-up†	*P*-value
Mentally disabled (21)	1.85	1.15	0.000
Cerebral palsy (7)	1.83	1.71	0.102
Trisomy 21 (10)	1.90	1.10	0.011
Autism (5)	1.88	1.13	0.083
Learning difficulties (48)	1.85	1.15	0.000
Other pathologies (6)	1.75	1.25	0.317

*Kruskal–Wallis ($\chi^2 = 9.452$; $P = 0.092$).
†Kruskal–Wallis ($\chi^2 = 9.326$; $P = 0.097$).

Table 5. **Comparison of baseline and follow-up DI-S scores by teeth**

#Tooth	Baseline	Follow-up	Correlation	*P*-value
16	2.18	1.53	0.510	0.000
11	1.77	1.01	0.561	0.000
26	1.97	1.35	0.474	0.000
36	1.81	1.30	0.434	0.000
31	1.47	0.95	0.324	0.000
46	1.96	1.25	0.386	0.000

Individuals with Trisomy 21 had the highest initial value (2.27) and the subjects belonging to the other pathologies group the lowest baseline score (1.50).

The analysis of type of teeth (Table 5) revealed that the anterior teeth (#11 and 31) were the ones that present least plaque at the beginning and final examination. All types of teeth present a reduction of plaque index ranging from 0.76 to 0.51. The posterior maxillary teeth presented the highest plaque score of all the index teeth examined.

Discussion

As dental plaque plays an important role in the establishment and development of oral disease, the current programme aimed to establish toothbrushing on a regular basis. Several studies have shown that toothbrushing programmes are effective in improving oral hygiene in populations with various types of disabilities (8).

The present study shows poor levels of oral hygiene as measured by the DI-S. At the beginning of the programme, the level of oral hygiene was poor with a mean plaque score of 1.86. Most of the individuals (81.3%) improved their efficacy in removing plaque, and at 3 months the mean plaque score was 1.24, which is considered to be fair (12).

The accumulation of supragingival plaque and the development of gingivitis are well established (14). One shortcoming of this study was a lack of gingival health assessment and its correlation with DI-S score. This was due to the difficulty in using the periodontal probe in most of the individuals.

Although the differences between initial and final values were significant within female and male groups, no significant difference was found between groups. This finding is consistent with Shyama *et al.* (8), where no differences were found between males and females. However, in this study, the female group presented worst hygiene levels, which is contrary to that found in the literature (8, 15). Nevertheless, the best absolute reduction was achieved in the female group revealing that perhaps after the first intervention, they were more motivated than men to perform toothbrushing.

Some studies (3, 8) suggest that the younger groups present better plaque scores. In the present study, no significant difference was found between age groups, even though the oldest age group had the highest initial and the lowest final values.

In analysing the type of tooth differences in plaque score, we could expect that the molar teeth had the highest values (14, 16). This was verified in this study where the facial surfaces of teeth 16 and 26 presented more plaque at both evaluations.

This could be explained by the difficulty of access to these teeth and difficulty in neuromuscular control (10). The participants in this study presented a wide range of disabling conditions and some differences in plaque scores could be expected related to distinct pathologies (7, 17).

In the present study, no difference was found between groups either in baseline or at follow-up observations regarding disabling condition. In addition, only a significant difference within groups was found for individuals with mental disability, Trisomy 21 and with learning difficulties. A possible explanation for the finding is that these individuals without motor problems with proper training could master easily their capacities in removing plaque.

Weekly supervision, reinforcement and adjustment of toothbrushing technique by the dental hygienist and daily practice at the institution with staff supervision allowed many subjects to alter the number of areas brushed. At the beginning of the study, a small percentage (8.8%) of individuals brushed all areas compared with 48.6% at follow-up. In addition, at the end of the programme, almost half of the group had no difficulty in brushing the facial and occlusal area, but failed to reach the oral surfaces. This was especially true in case of those with less manual dexterity.

Ideally, an evaluation study should include a control or comparison group preferably one belonging to the same population. However, it was regarded unethical to deny a proportion of individuals the opportunity for an obvious improvement in their level of oral hygiene.

As discussed earlier, the oral health of disabled individuals is not a priority for themselves or for the staff who support them. At the beginning of our intervention, few caregivers performed/supervised toothbrushing. This short-term study involving disabled individuals and their caregivers revealed that systematic instruction, continuous evaluation and reinforcement showed a beneficial effect on plaque score. A follow-up study should investigate the maintenance of this effect and at what degree the motivation and willingness to maintain toothbrushing routine continues after the programme has ended. As suggested by Kay and Locker (11), a periodic reinforcement to monitor the procedure is the best approach to obtain compliance. For our own experience, we suggest professional reinforcement every 3 months.

Conclusion

The implemented programme seems to have promoted changes in oral health attitudes and behaviours among participants with the majority of the individuals developing self-care skills and some dexterity in brushing. Although the study had included subjects with different disabling conditions, as a group they were capable of being educated in oral hygiene practices and were able to perform toothbrushing without help as long as reminded, encouraged and supported by the dental hygienist or the staff. The activities developed were very well accepted by both the subjects and staff. At the beginning of the programme, toothbrushing was not a common procedure at the institution. This study shows that it is possible to implement a toothbrushing routine provided reinforcement can be offered on a regular basis.

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