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Improved compliance and self-care in patients with periodontitis – a randomized control trial

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Abstract: The present study was a randomized control trial to test an intervention emanating from the Client Self-care Commitment Model (CSCCM), to encourage patients to increase their responsibility for their oral self-care. *Materials and methods:* A total of 75 individuals were re-examined 1–2 years after their initial therapy at the Department of Periodontology, Uppsala County Council, Sweden. Patients who exhibited insufficient compliance, 37 individuals, were included in a randomized single-blind control trial to test an intervention based on the CSCCM. Patients were examined at baseline and 3 months after hygiene treatment. *Results:* The results demonstrated that patients in the intervention (IV) group increased their interdental cleaning and reduced their plaque index significantly compared with the control group. The former also reduced the number of periodontal pockets >4 mm significantly from baseline until after the hygiene treatment. The majority of the individuals in the IV group reported that the written commitment had influenced on their oral self-care habits in a positive direction. *Conclusions:* The CSCCM enhanced the client participation in the treatment process and improved the compliance and oral self-care behaviours. In addition, the model contributed to a reduction in periodontal pockets.

Key words: Client Self-care Commitment Model; compliance; dental hygienist; oral self-care

Introduction

There are difficulties in developing effective strategies to improve long-term patient compliance with health promotion regimens, especially for chronic diseases and if lifestyle changes

are necessary (1). Periodontal diseases, as a quite common inflammatory oral disease among adults (2), have many characteristics that influence the distribution and seriousness of the disease; the oral biofilm, the individual immune-response, genetics, smoking habits, the patients oral self-care and plaque-control are some factors that contribute to the development of the disease (3). As the bacterial environment plays a central role, the treatment strategy focuses on the removal of the bacterial-plaque and the success of the treatment depends on the capacity of the patient's oral self-care, the skilfulness of the operator, type of bacteria, and the individual immune-response (4, 5). Many studies have shown the importance of individual-adjusted maintenance- and self-care programmes to achieve and keep a satisfactory oral health status (6–8). Compliance with recommendations to medical or dental treatment is of potential importance for treatment success (9, 10). For individuals, treated for periodontitis, compliance often means to what extent patients follow recommendations for the frequency of tooth brushing and interdental cleaning but also the frequency of their dental visits (9, 11). To prevent development of dental caries and gingivitis the usual recommendation is to brush the teeth twice a day and at least clean interdentally once a day (10). In a Swedish study, Hugoson et al. (12) showed that approximately 80% of the individuals followed the recommendations and brushed their teeth twice a day. For interproximal cleaning, it is even more difficult to achieve optimal compliance. Johansson et al. (13) showed that only half of the population used the recommended oral cleaning aids after 3 years. The increased time-consumption and the necessity of manual dexterity have been some explanations for the less frequent use of interdental cleaning (14). Several factors have impact on individuals compliance, e.g. attitudes, self-efficacy, health behaviour, health promotion and education and are studied from different perspectives (15–21) indicating that there is a need for a more careful approach to the concept of compliance. Hamman Calley et al. (22) describes a shift from the traditional biomedical approach to new health paradigms. New health paradigms emphasize on client involvement and commitments to positive health behaviours and to the decision process (23). The biomedical approach means that the authority does not rest with the client and that the caregiver determines the behaviour best suited to the client, and implies that the client will comply (22). Rosenberg et al. (24) discussed the importance of patient perspective and argued that if a patients' dental care expectations are not taken into consideration in the formulation of a treatment plan, then compliance and outcome may be negatively affected. Models have been described for achieving more patient participation in oral health care such as

Human Needs Conceptual Model and State of Change (25, 26). Hamman Calley et al. have recently described a model for health education: The Client Self-care Commitment Model (CSCCM) (22) based on Client Empowerment Model (27), Explanatory Model (28) and Human Needs Conceptual Model (25) to be useful both in patient-work and research. With this health education model the patient should be encouraged to take their own decisions to improve their oral health.

Client Self-care Commitment Model

The method implies that the dental hygienist (DH) works in dialogue with the patient aiming at increasing the empowerment. The dialogue results in a commitment where the patient establishes goals set by themselves. CSCCM incorporates five different domains or phases; initiation, assessment, negotiation, commitment and evaluation. The initiation and the start of the dental hygiene care means that the patients bring their own explanatory model of self-care methods and disease processes, beliefs and values. The DH must identify these beliefs and assist the client in disclosing her or his chief concern. In the assessment phase, the dental hygienist uses questions, strategies to disclose client perceptions of self-care behaviours, knowledge of biomedical facts and illness experiences. Clients assimilated new information from health professionals when they judge the information more useful than old ideas. The client and DH become co-therapists when the explanatory models are verbalized and negotiate self-care behaviours, treatment and recall interval. In the negotiation phase, the DH acts as a resource person with whom the patient can explore alternatives for treatment and oral self-care. The differences between the DH and patient explanatory model are reconciled, and self-care behaviours are negotiated; the DH assists the patient to establish self-selected goals as a commitment in the commitment phase. The client makes the decisions and the DH assists in their achievement. During the last appointment, the patients report their compliance with the established self-care commitment, the evaluation phase.

The aim of the present study was to test an intervention emanating from the CSCCM, to encourage patients to increase their responsibility for their oral self-care.

Materials and methods

Design

The study was a randomized single-blind control trial to test an intervention based on CSCCM (Fig. 1).
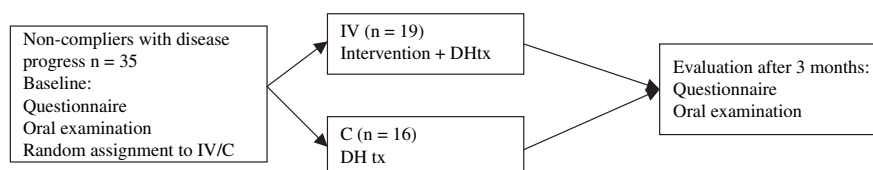
Fig. 1. The study design (IV = Intervention group, C = control group, DH = dental hygienist, tx = treatment).

Subjects

Out of 75 patients re-examined 1–2 years after their initial therapy at the Department of Periodontology, the County Council of Uppsala, Sweden, 37 individuals had insufficient compliance and progress of their periodontal disease. These 37 individuals were invited to participate in the study.

Inclusion criteria

Individuals 20–80 years of age with insufficient compliance, which was defined as individuals who reported interdental cleaning (tooth picks or interdental brushes) less than five times a week combined with a dental plaque score >0.20 according to Silness and Löe (29). To avoid missing the individuals who over-reported their interdental cleaning, patients who reported interdental cleaning ≥5 times a week but nevertheless showed a dental plaque scores >0.40, were also included. Dental plaque scores >0.40 has been considered by Lang *et al.* (30) as a marker for insufficient plaque control and increasing risk for disease progression.

Bleeding on probing (BoP) >25% and teeth with recurrent pocket depth >4 mm was considered as a progress of the periodontal disease in concordance with Lang *et al.* (30).

Random assignment

The patients were randomized into two groups, the intervention group (IV), and control group (C) (Fig. 1). The randomization was organized by giving the 10 individuals a number. By using a lottery, the first five numbers were included to the IV and the rest to the C group. Two of the patients dropped out; one became ill, and one declined treatment at the clinic for Periodontology. The intervention was evaluated with a final examination between 12 and 14 weeks after the start of the dental hygiene treatment. The IV group consisted of 19 patients (10 men and nine women) and C group of 16 patients (eight men and eight women). There were five smokers in each group (Table 1).

Table 1. **Patient characteristics**

	IV group	C group
Female/male	9/10	8/8
No. of smokers	5	5
Age (years)	54.8 ± 11.7 (25–74)	58.1 ± 9.9 (41–78)
No. of teeth	22.9 ± 4.1 (14–28)	22.8 ± 3.7 (16–30)

Instruments

Questionnaire

All participants were given a questionnaire at baseline and at the end of the study. The questionnaire covered oral self-care habits such as frequency of tooth brushing and interdental cleaning, type of interdental cleaning aid, time spent and reasons for cleaning the teeth and finally demographic data. At the end of the study, there were additional questions regarding possible change in their oral self-care. For the IV group, the questionnaire also included questions if the written commitment had had any influence on their oral self-care habits.

Clinical assessment

The clinical assessments were performed at baseline and at the final evaluation by the same examiner, an experienced periodontist (N.O.) who was blind to the group allocation. The examination consisted of plaque index (PlI) according to Silness and Löe (29), gingival index (GI) according to Löe and Silness (31), probing pocket depth (PD) measuring six sites (mesio-, mid-, disto-buccal, and mesio-, mid-, disto-lingual) per tooth, and BoP recorded on four sites as absent or present and summarized as a percentage index for all teeth.

Procedures

The dental hygiene treatment and intervention

An experienced DH (B.J.) performed all the dental hygiene treatment and the intervention. The patients in the IV and the C groups received four and three visits respectively. The

CSCCM was used to enhance patient compliance regarding their self-care behaviours (i.e. interdental cleaning) for the IV group.

Intervention group

Visit 1. The first visit started with the *initiation phase*. The patient presented their own explanatory model of self-care methods and disease processes, experiences of earlier treatments, and their beliefs about the reasons for disease progress. Thereafter, the last periodontal status was demonstrated, discussed, and compared with previous status. In the *assessment phase*, the DH used interview strategies with the help of an interview guide (22) to disclose patient's perceptions of self-care behaviours, knowledge of biomedical facts, and illness experiences. As an additional component of the commitment process, the DH provided the patient with the explanatory model of periodontitis. Depending on the patient responses, the DH provided further information if necessary. The *negotiation phase* started with the DH exploring the patients present oral hygiene status by using an Erytrosin based colouring disclosure agent (Rondell Red; Nordenta, Enköping, Sweden) after which appropriate dental cleaning aids were introduced. Thereafter, the DH and the patient discussed and negotiated with the purpose to achieve an improvement in oral hygiene. The DH assisted the patient to establish self-selected goals in the *commitment phase*. A goal was established from the patient's individual requirements for toothbrush frequencies (i.e. how often and when during the day), interdental cleaning frequencies (i.e. how often and when during the week), and tooth surfaces of particular importance for cleaning. The patient made the decisions with the assisting of the DH. The result of the decision was documented in a written commitment containing: type of cleaning aid, frequencies and special areas. If there was enough time available at the first visit, scaling was performed.

Visit 2. At the next visit (after 1–2 weeks) the client reported their compliance with the established self-care commitment (*evaluation phase*). The oral hygiene status was checked by using an Erytrosin based colouring disclosure agent (Rondell Red; Nordenta, Enköping, Sweden) and new instructions and adjustments of technique were discussed if necessary. If the clients had new requirements for the commitment, adjustments were made. Necessary scaling and polishing were provided.

Visit 3. The experimental group did receive an extra appointment compared with the C group approximately 4 weeks after baseline and the written commitment. The aim with the visit was to check if the patients had found the self-

selected goals realistic and if any changes were necessary. No other treatment was performed.

Visit 4. The final evaluation was performed 12–14 weeks after the first visit. The patients were given the second questionnaire. The same dentist performed the same clinical assessments as at baseline. The data from the clinical assessments were analysed and discussed with the patient. The commitment was also evaluated and adjusted if necessary. Finally, the recall intervals were discussed and established.

Control group

Visit 1. The latest periodontal status was demonstrated, discussed and compared with previous status. New information about the periodontal disease was given if necessary. The oral hygiene instructions was performed, controlled and adjusted if necessary, by using a colouring disclosure agent (diaplaque Oral Pharma®). Necessary scaling and polishing were provided.

Visit 2. At the next visit (after 1–2 weeks), the oral hygiene status was checked by using a colouring disclosure agent (diaplaque Oral Pharma®) and new instructions and adjustments of technique were discussed if necessary. Necessary scaling and polishing were provided.

Visit 3. The final evaluation was performed 12–14 weeks after the first visit. The patients were given the second questionnaire. The same dentist performed the same clinical assessments as at baseline. The data from the clinical assessments were analysed and discussed with the patient. Finally, the recall intervals were discussed and established.

Informed consent was obtained from the patients and the research Ethics Committee of the Faculty of Medicine, Uppsala University approved the study.

Analyses

The software Stat view 5.0 (SAS Institute Inc., Cary, NC, USA) was used for the analyses. Descriptive statistics was used to present frequency of interdental cleaning and periodontal findings. A change in interdental cleaning was categorized as an increase to >5 days week^{-1}. The differences in reported change in interdental cleaning was tested with chi-squared test. Differences between the IV and C groups with regard to clinical assessment were analysed with unpaired *t*-test. The differences between baseline and final evaluation regarding clinical assessment were tested with paired *t*-test. Considering the fact that it is more difficult for individuals with very low PlI scores to improve their index, a percentage mean plaque

reduction was also analysed with paired t-test. A $P < 0.05$ was regarded as statistically significant.

Results

Oral self-care habits

Three individuals reported at baseline that they brushed their teeth once a day and the other 32 that they brushed twice daily. At the final examination, there was no change concerning the frequency of tooth brushing among the individuals. The three individuals that brushed their teeth once a day did so even at the final examination and they all belonged to the IV group. They had also stated as their self-selected goals in the commitment to brush once a day. There were no statistically significant difference between the plaque scores for those brushing once a day (0.25) compared with the individuals brushing their teeth more often (0.29) at the final examination.

A significantly higher proportion of patients in the IV group (79%) increased their use of interdental cleaning from baseline to the final examination compared with patients in the C group (6%) ($\chi^2 = 6.93$; d.f. = 1; $P = 0.008$) (Table 2).

A total of 78% in the IV group reported that the written commitment did influence their oral self-care behaviours in a positive way. Seventy-nine per cent found it valuable to establish self-selected goals for oral self-care.

Plaque index

No statistically significant differences could be found at baseline in any of the periodontal assessments. There was a statistically significant difference in PlI between the IV group (0.25 ± 0.11) and the C group (0.33 ± 0.11) ($t = 2.21$; d.f. = 33; $P = 0.03$) at the final examination. The plaque reduction was significantly higher for the IV group (56%) compared with the C group (35%) ($t = 2.49$; d.f. = 33; $P = 0.02$) (Table 3). However, a statistically significant reduction of PlI was seen at the final examination compared with baseline for both groups (IV: $t = 8.37$; d.f. = 18; $P < 0.0001$) (C: $t = 3.88$; d.f. = 15; $P = 0.002$).

Table 3. Plaque index (PlI) and percentage reduction of PlI at baseline and final examination across IV/C groups

Group	Baseline	Final examination	% reduction
IV	0.59 ± 0.17 (CI 0.51–0.67)	0.25 ± 0.11* (CI 0.20–0.30)	−56.2 ± 18.0* (CI −64.9 to −47.5)
C	0.59 ± 0.29 (CI 0.44–0.75)	0.33 ± 0.11 (CI 0.27–0.39)	−35.1 ± 31.1 (CI −51.7 to −18.6)

*Statistically significant difference between IV and C groups. No statistically significant difference between the groups could be found at baseline.

Gingival index and bleeding on probing

In both groups, there was a statistically significant reduction of GI (IV: $t = 7.59$; d.f. = 18; $P < 0.0001$) (C: $t = 4.07$; d.f. = 15; $P = 0.001$) and BoP (IV: $t = 9.30$; d.f. = 18; $P < 0.0001$) (C: $t = 5.07$; d.f. = 15; $P = 0.0001$). No statistically significant difference between the IV and the C groups with regard to GI or BoP could be found (Table 4).

Periodontal pocket depth

There was a significant reduction in the number of pockets >4 mm from baseline (5.8) to the final examination (2.7) ($t = 4.7$; d.f. = 18; $P < 0.001$) in the IV group. No significant reduction could be found in the C group (Table 5). There was no significant difference in the number of pockets >4 mm between the IV and the C groups at the final examination.

Table 4. Gingival index (GI), bleeding on probing (BoP) and percentage reduction of GI and BoP at baseline and final examination across IV/C groups

Group	Baseline	Final examination	% reduction
GI in IV	0.73 ± 0.14 (CI 0.66–0.79)	0.38 ± 0.20 (CI 0.28–0.48)	−47.8 ± 25.1 (CI −59.9 to −35.7)
GI in C	0.65 ± 0.23 (CI 0.53–0.77)	0.39 ± 0.14 (CI 0.39–0.46)	−33.8 ± 34.6 (CI −52.3 to −15.4)
BoP (%) in IV	46.8 ± 13.8 (CI 40.2–53.5)	18.7 ± 8.3 (CI 14.7–22.8)	−58.4 ± 17.7 (CI −66.9 to −49.8)
BoP (%) in C	39.0 ± 16.0 (CI 30.5–47.5)	16.3 ± 5.7 (CI 13.3–19.3)	−51.5 ± 24.8 (CI −64.6 to −38.3)

No statistically significant difference between the groups could be found at baseline or final examination.

Table 2. Reported interdental cleaning ≥5 times/week at baseline and final examination across IV/C groups

Group	Baseline	Final examination	% increased use
IV	4	19*	79
C	10	11	6

*Statistically significant difference between IV and C groups. IV, intervention group; C, control group.

Table 5. Number of pockets >4 mm at baseline and final examination across IV/C groups

Group	Baseline	Final examination
IV	5.8 ± 3.9 (CI 3.9–7.7)	−2.7 ± 3.0 (CI 1.2–4.1)
C	4.9 ± 6.7 (CI 1.3–8.4)	−2.9 ± 3.1 (CI 1.2–4.5)

No statistically significant difference between the groups could be found at baseline or final examination.

Discussion

Patients in the IV group increased their interdental cleaning and reduced their PlI significantly compared with those in the C group. The IV group also reduced the number of periodontal pockets >4 mm significantly from baseline until after the hygiene treatment. In addition, there was a tendency to higher reduction of BoP in the IV group although it did not reach a significant level. The majority of the individuals in the IV group reported that the written commitment had influenced on their oral self-care habits in a positive direction, which was confirmed with a significant reduction of PlI. This demonstrated that the patients find it satisfactory to be involved in decision making and to be an active part in the treatment process. The results indicate that CSCCM increased the patients' responsibility for their oral self-care, which is in line with Hamman Calley *et al.* (22). The same DH (B.J.) performed the hygiene treatment, i.e. scaling in both groups indicating that the greater improvement in periodontal status in the IV group is explained by improved plaque control. However, the periodontal conditions showed considerable improvements in both groups after the hygiene treatment, which correspond to similar results in other studies (32, 33). The patients in both groups may be considered as individuals with difficulties to comply with recommendations. Before the start of the study, they had all received periodontal treatment 1 or 2 years earlier and in spite of that treatment they still had insufficient compliance and progress of their periodontal disease. There is obviously a group of patients where traditional information and instruction neglecting the patients' perspective is not sufficient. The main difference between the study groups is that the individuals in the IV group established self-selected goals for self-care formulated as a commitment between the patient and the DH. Patient empowerment is described (22) as the process in which the individuals are prepared to make informed decisions and take charge of their own (health) situation (oral self-care), which is an important and crucial part in the CSCCM. Individuals in the IV group were encouraged and were given authority to make their own decisions about their oral health self-care. Individuals in the C group obtained a traditional information and instruction about oral hygiene based on scientific evidence but mainly seen from the DH perspective, which seems to be less effective.

Methodological issues

Individuals in the IV group obtained one extra visit to confirm the commitment. It is well known that recall visits are effective in preserving health behaviour and to disclose signs of misbehaviour before they cause any problem (9). The evaluation period for both the IV and the C groups (approximately 3 months) was within the traditional recommended time interval to preserve improved oral hygiene habits in a maintenance program. Three months have, in the study by Axelsson and Lindhe (7), been described as sufficient for these purposes. It is, therefore, unlikely but possible to believe that this extra visit could explain the differences between the two study groups.

The results were evaluated after the hygiene treatment, a period of 3 months. Previous studies have shown that positive outcomes often can be achieved in the short run (34–36). It would be of interest to evaluate the result of the CSCCM in a longitudinal study to investigate if the results remain after an extended period of time. The positive improvements that individuals in the IV group received by the use of the CSCCM will probably need to be followed up, adjusted and sometimes the commitment has to be reformulated and new self-selected goals established. An adequate maintenance program is necessary independent of the method used for information. One objective and a challenge for treatment of different chronicle diseases is to achieve a long-term commitment for individuals for whom the standardized treatment protocols are not suitable. CSCCM, evaluated and discussed in the present study, is one approach that could be useful as an instrument to increase the patients' participation. The study population was quite small, but still significant results could be demonstrated regarding interdental cleaning and plaque reduction, however, the sample size may be too limited to show significant reduction in GI and BoP. Consequently, it would be of interest to study the use of CSCCM in a larger study population.

There is a need for more research in this area. There is an increase in scientific evidence on how to treat periodontal disease from a biological perspective but limited knowledge on how to encourage patients to take responsibility for their own oral self-care.

Conclusions

The CSCCM enhanced the client participation in the treatment process and stimulated to improved oral self-care behaviours. In addition, the model contributed to a reduction in periodontal pockets.

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