

Application of transtheoretical model to assess the compliance of chronic periodontitis patients to periodontal therapy

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Abstract

Background: The present cross-sectional survey study was conducted to assess whether the transtheoretical model for oral hygiene behavior was interrelated in theoretically consistent directions in chronic periodontitis patients and its applicability to assess the compliance of the chronic periodontitis patients to the treatment suggested. **Materials and Methods:** A total of 150 chronic periodontitis patients were selected for the proposed study. The selected patients were given four questionnaires that were constructed based on transtheoretical model (TTM), and the patients were divided subsequently into five different groups (precontemplation, contemplation, preparation, action, and maintenance groups) based on their answers to the questionnaires. Then, each patient was given four appointments for their periodontal treatment spaced with a time gap of 10 days. The patients visit for each appointments scheduled to them was documented. The results obtained were assessed using TTM. **Results:** Higher mean pro scores of decisional balance, self-efficacy, and process of change scores was recorded in maintenance group followed by action group, preparation group, contemplation group, and precontemplation group, respectively, whereas higher mean cons score was recorded in precontemplation group followed by contemplation group, preparation group, action group, and maintenance group, respectively. The difference scores of TTM constructs were statistically highly significant between all the five groups. Furthermore, the number of appointment attended in were significantly more than maintenance group followed by action group, preparation group, contemplation group, and precontemplation group. **Conclusion:** Within the limitations of this study, it can be concluded that transtheoretical model can be successfully applied to chronic periodontitis patients to assess their compliance to the suggested periodontal treatment.

Keywords: Chronic periodontitis, patient compliance, transtheoretical model

Introduction

Periodontal disease is one of the most widespread chronic diseases worldwide.^[1] Untreated chronic periodontitis is responsible for tooth loss in the majority of the cases.^[2] The presence of periodontal disease has been proved to be a significant risk factor for several systemic diseases, for example, preterm low birth weight babies, coronary artery diseases, diabetes mellitus, etc.^[3] It has also been recognized as one of the major public health issues in developing countries like India where more than 50% of population are affected.

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As established by Löe *et al.*,^[4] dental plaque is the major etiological agent responsible for periodontal disease, and hence, the control of biofilm accumulation on teeth has been the key to periodontal disease treatment and prevention. Toothbrushing, use of dental floss to remove bacterial plaque from the teeth, is the most common ways of removing biofilm. Personal oral hygiene performed with a manual toothbrush is presently the most widespread method for controlling plaque, cleaning the teeth, and maintaining gingival health.^[5] Despite its important role in the control of periodontal disease, mechanical plaque control is not properly practiced by most individuals.^[6] The high worldwide rates of gingivitis and periodontal disease suggest that a majority of adults are not accomplishing sufficient daily plaque removal using their customary oral hygiene regimens, which studies show most typically consist of at least once daily tooth brushing with a manual brush and infrequent or no targeted interdental plaque removal.

Successful long-term periodontal therapy requires exceptional patient compliance to a periodontal

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How to cite this article: Emani S, Thomas R, Shah R, Mehta DS. Application of transtheoretical model to assess the compliance of chronic periodontitis patients to periodontal therapy. *Contemp Clin Dent* 2016;7:176-81.

Access this article online	
Quick Response Code: 	Website: www.contempclindent.org
	DOI: 10.4103/0976-237X.183068

maintenance program.^[7] Unlike other diseases of the oral cavity that produce acute pain and discomfort, patients with periodontal disease do not feel the need to be compliant with the recall visits scheduled by the practitioner as periodontal disease is primarily painless. Although maintenance is necessary to retain benefits of treatment and to prevent relapse, 100% patient compliance (i.e., attendance at all maintenance appointments) has been reported to be as low as 16%, with nearly 34% of patients failing to return for maintenance after completion of active therapy.^[7] Although several social, behavioral, cultural, and economic factors have been implicated in determining patterns of compliance, the influence of personality characteristics on attitudes driving these behavioral responses remains to be explored.^[8]

Health behavior change of an individual is a key component in the prevention of disease. Unfortunately, behavior change is often the most neglected step in the implementation and maintenance of these preventive lifestyle behaviors. To understand the process of behavior change, several theories have been proposed that include Theory of planned behavior,^[9] Self-regulation theory,^[10] Self-efficacy theory,^[11] and intentional actions.^[12] The transtheoretical model (TTM) of behavior change was developed to understand how individuals progress toward establishing and maintaining a positive health behavior change.^[13] The model consists of six stages of change, precontemplation: The individual who had no intention to take action within the next 6 months and is generally un- or under-aware of the problem. Contemplation: The individual intended to take action within the next 6 months. He or she is aware that a problem exists but has not yet made a commitment to take action. Preparation: The individual intended to take action within the next 30 days and has taken some behavioral steps in this direction. Action: The individual changed his or her overt behavior for <6 months. Maintenance: The individual changed his or her overt behavior for more than 6 months and works to prevent relapse and consolidate the gains attained. The key to using this theory in practice is to assess the patient's stage and then educate and persuade the patient to move toward the next stage.^[14] For many problematic behaviors, TTM has been applied and staging algorithms specific to the behavior have been developed.^[15]

It has been proposed that the compliance of a patient to the periodontal treatment is very important to achieve a predictable periodontal outcome, and tooth brushing twice a day is one of the basic mechanical plaque control methods to prevent the periodontal disease. Hence, the aim of the present study was to assess the compliance of chronic periodontitis patients to the proposed treatment plan by applying TTM of behavior change based on their daily brushing habits and also to evaluate the applicability of TTM to assess the compliance of the chronic periodontitis patients to the treatment suggested.

Materials and Methods

For this proposed study, patients with chronic periodontitis with an age range of 35–50 years of both the sexes were selected from the outpatient department of periodontology. Each patient was given a detailed verbal and written description of the study and was asked to sign a written consent form before commencement of the study.

Systemically healthy patients with chronic periodontitis where there were ≥ 2 interproximal sites with ≥ 4 mm pocket depth (not on same tooth) or 1 site with ≥ 5 mm PD and who required at least minimum of four appointments of phase I periodontal therapy were selected for the study. Developmentally physically challenged and/or mentally challenged and those unable to independently perform oral hygiene tasks and patients under psychiatric therapy were excluded from the study. Patients who had undergone periodontal therapy in the past 6 months were also not considered for the study.

Study design and procedure

A total of 150 chronic periodontitis patients were selected. The selected patients were given a questionnaire consisting of four sections that were constructed based on TTM and were divided subsequently into five different groups (precontemplation, contemplation, preparation, action, and maintenance groups) based on their response to the questionnaire. Then, each patient was given four appointments spaced with a time gap of 10 days. Full mouth scaling was completed in the first appointment. The second, third, and fourth appointments were scheduled for root planing and curettage. The patients visit for each appointments scheduled to them was documented. Those who kept all the appointments given to them were said to be compliant to the prescribed treatment plan. The results obtained were assessed using TTM. For each patient, their regularity to the appointments scheduled, that is, their compliance to the suggested treatment was correlated with their answers to the questionnaires of TTM.

Transtheoretical model measures

It was a four question algorithm that placed individuals in a category of behavior change: Precontemplation, contemplation, preparation, action, and maintenance. This instrument has been tested and found reliable and valid on the adult hygiene of patients. A close-ended four question algorithm was used. It was slightly modified in content to apply to it know about the toothbrushing habits of the patients.^[16] TTM has four different instruments to measure.

The first questionnaire included the basic demographic data of the patient along with stages of change measure [Figure 1]. The second questionnaire is decisional balance measure. The third questionnaire is self-efficacy scale, and the fourth questionnaire is for processes of change measure.

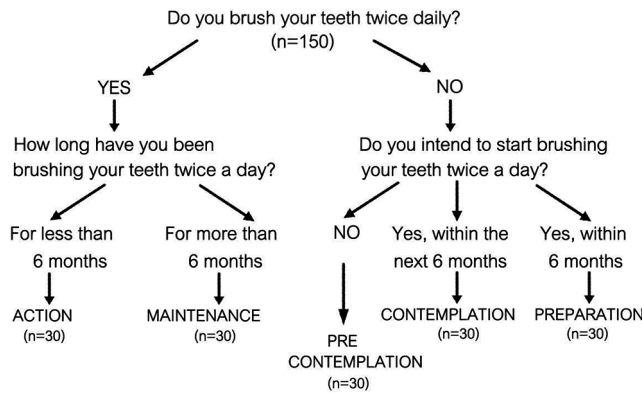


Figure 1: Flow chart for stages of change questionnaire

Stages of change measure

This questionnaire is used to identify the stage of TTM that patient belongs to. It is based on the flowchart demonstrated in Figure 1.

Decisional balance measure

This is a scale that assesses readiness to change by analyzing the distribution of the pros and cons a person considers when making a behavioral change. The inventory assessed ten items of which the first five reflected the pros of brushing teeth twice a day and the last five items reflected the cons of brushing teeth twice a day. The items employed a five-point Likert scale ranging from 1 (not important) to 5 (extremely important).

Self-efficacy scale

This scale measures how confident a person is that he/she will continue the new behavior even in the face of temptation. This inventory had ten items. Individuals were asked to rate “how confident they were that they could brush their teeth twice a day” the circumstances described in the questionnaires arise to them. The items employed a five-point Likert scale ranging from 1 (not at all confident) to 5 (completely confident).

Processes of change

This scale identifies the processes of change used by individuals to encourage positive movements through the stages. This inventory had ten statements that describe an action or thought that a person might use to help them to brush their teeth twice a day. There are ten different processes of changes and each statement in the questionnaire is used to assess each of the ten processes. The items employed a five-point Likert scale ranging from 1 (never) to 5 (repeatedly).

Statistical analysis

Data were monitored, coded, and entered as received. The Likert scale values for each questionnaire of the individual patient were added and subjected to statistical analysis. The statistical analysis was performed using SPSS version 16.0 software (IBM, USA). Results were presented as mean \pm

standard deviation. Comparisons of three measures of TTM (decisional balance, self-efficacy, and processes of change) and the number of appointments attended by the patient were compared using Kruskal–Wallis test and Mann–Whitney test.

Results

Comparisons of pro and cons scores among the groups

Higher mean pro score was recorded in maintenance group (19 ± 4.14) followed by action group (18 ± 1.37), preparation group (13 ± 2.31), contemplation group (10.23 ± 2.68), and precontemplation group (5.94 ± 0.17), respectively. Higher mean cons score was recorded in precontemplation group (15 ± 3.51) followed by contemplation group (14 ± 3.47), preparation group (11.42 ± 1.77), action group (8.74 ± 1.24), and maintenance group (7.97 ± 4.14), respectively. The difference in mean pro and cons scores among the groups was found to be statistically highly significant ($P < 0.001$) [Table 1].

Comparison of self-efficacy score among the groups

Higher mean self-efficacy score was recorded in maintenance group (38.87 ± 8.82) followed by action group (34.19 ± 2.54), preparation group (23.71 ± 4.68), contemplation group (18.58 ± 2.41), and precontemplation group (15.81 ± 6.78), respectively. The difference in mean self-efficacy score among the groups was found to be statistically highly significant. ($P < 0.001$) [Table 2].

Comparison of process of change score among the groups

Higher mean process of change score was recorded in maintenance group (40 ± 8.7) followed by action group (34 ± 2.06), preparation group (23.65 ± 4.53), contemplation group (18 ± 1.62), and precontemplation group (15 ± 5.96), respectively. The difference in mean pro score among the groups was found to be statistically highly significant ($P < 0.001$) [Table 2].

Comparison of number of appointments attended among the groups

Higher mean number of appointments attended was recorded in maintenance group (2.71 ± 1.04) followed by action group (2.48 ± 0.89), preparation group (2.39 ± 0.95), contemplation group (1.84 ± 0.86), and precontemplation group (1.42 ± 0.96), respectively.

The difference in a mean number of appointments among the groups was found to be statistically highly significant ($P < 0.001$) [Table 2]. Results of multiple comparisons using Mann–Whitney test among different pairs of groups are tabulated in Tables 3 and 4.

Discussion

Mechanical plaque removal using a toothbrush twice daily, together with daily interdental cleaning, has long been recommended as an effective oral hygiene regimen.

Effectiveness of toothbrushing depends on various factors such as toothbrush design, brushing technique, frequency, and time spent brushing for brushing.^[17] A study on toothbrushing behavior in many European countries says that majority of the population claims to brush at least once a day, but the data indicate that the brushing behavior currently in practice does not provide efficient plaque control.^[18] This apparent discrepancy may be due to an overestimation of brushing frequency as a consequence of self-reporting, poor brushing technique, or lack of appropriate oral hygiene products.

Noncompliance of a patient in periodontal terms may lead to poor oral hygiene, periodontal disease, and poor periodontal treatment outcomes. Noncompliance of a patient to any treatment may be the result of internal factors or

external factors.^[19] Internal factors include fear and anxiety about visiting the dentist or hygienist, fear of pain, fear of needles, lack of understanding, poor communication, apathy, perceived or real lack of time, lifestyle, age, health beliefs, perceived unimportance of treatment and/or oral care, physical and psychological health, low self-esteem, and embarrassment.^[20-24] External factors can include poor communication or involvement (by providers and others), stress, community influences, and socioeconomic status.^[21,22] Interventions that may help address these internal and external factors influencing compliance include patient communication and education, behavioral modification programs, psychological help, and selected therapies.

In the early 1980's, DiClemente and Prochaska began to work on the TTM in an attempt to understand how people intentionally modify behavior.^[13] In the present study, all the four constructs of the TTM including the stage of change, processes of change, decisional balance, and self-efficacy were assessed. Our main findings were that decisional pros and cons varied significantly by stage, processes of change varied significantly by stage, decisional balance varied significantly by stage, and self-efficacy varied significantly by stage. Overall, the direction of the findings was theoretically consistent.

The TTM was chosen for this study over other behavioral models as they fail to view behavior modification as a

Table 1: Comparison of pros and cons scores among the groups

Group	Pros scores			Cons scores		
	Mean	SD	P	Mean	SD	P
Precontemplation	5.94	0.93	<0.001*	15.94	3.51	<0.001*
Contemplation	10.23	2.68		14.00	3.47	
Preparation	13.94	2.31		11.42	1.77	
Action	18.29	1.37		8.74	1.24	
Maintenance	19.90	4.14		7.97	4.14	

*Statistically highly significant. SD: standard deviation

Table 2: Comparison of self-efficacy and process of change scores and number of appointments among the groups

Group	Self-efficacy			Process of change			Number of appointments		
	Mean	SD	P	Mean	SD	P	Mean	SD	P
Precontemplation	15.81	6.78	<0.001*	15.39	5.96	<0.001*	1.42	0.96	<0.001*
Contemplation	18.58	2.41		18.35	1.62		1.84	0.86	
Preparation	23.71	4.68		23.65	4.53		2.39	0.95	
Action	34.19	2.54		34.39	2.06		2.48	0.89	
Maintenance	38.87	8.82		40.81	8.70		2.71	1.04	

*Statistically highly significant. SD: standard deviation

Table 3: Multiple comparisons of pro and cons scores between the groups

Group (I)	Group (J)	Pro scores		Cons scores	
		Mean difference (I-J)	P	Mean difference (I-J)	P
Precontemplation	Contemplation	4.290	<0.001*	1.935	0.003*
	Preparation	8.000	<0.001*	4.516	<0.001*
	Action	12.355	<0.001*	7.194	<0.001*
	Maintenance	13.968	<0.001*	7.968	<0.001*
Contemplation	Preparation	3.710	<0.001*	2.581	<0.001*
	Action	8.065	<0.001*	5.258	<0.001*
	Maintenance	9.677	<0.001*	6.032	<0.001*
Preparation	Action	4.355	<0.001*	2.677	<0.001*
	Maintenance	5.968	<0.001*	3.452	<0.001*
Action	Maintenance	1.613	0.002*	0.774	0.001*

Mann-Whitney U-test. *Statistically highly significant

Table 4: Multiple comparisons of self-efficacy, process of change scores and number of appointments between the groups

Group (I)	Group (J)	Self-efficacy		Process of change		Number of appointments	
		Mean difference	P	Mean difference	P	Mean difference (I-J)	P
Precontemplation	Contemplation	2.774	<0.001*	2.968	<0.001*	0.419	0.050**
	Preparation	7.903	<0.001*	8.258	<0.001*	0.968	<0.001*
	Action	18.387	<0.001*	19.000	<0.001*	1.065	<0.001*
	Maintenance	23.065	<0.001*	25.419	<0.001*	1.290	<0.001*
Contemplation	Preparation	5.129	<0.001*	5.290	<0.001*	0.548	0.015**
	Action	15.613	<0.001*	16.032	<0.001*	0.645	0.002**
	Maintenance	20.290	<0.001*	22.452	<0.001*	0.871	<0.001*
Preparation	Action	10.484	<0.001*	10.742	<0.001*	0.097	0.603
	Maintenance	15.161	<0.001*	17.161	<0.001*	0.323	0.121
Action	Maintenance	4.677	<0.001*	6.419	<0.001*	0.226	0.238

Mann-Whitney U-test. *Statistically highly significant; **Statistically significant

progression through stages. The TTM helps to address the evidence for stage-matched interventions. In addition, the TTM has become one of the most widely used program planning models in health promotion because it is the most validated with research.^[25] It is increasingly being used in the field of patient motivation and compliance in the field of medicine.^[26,27] Slowly, such behavioral models are being used and gaining acceptance in the field of dentistry for positive behavior modification among patients.^[28] Given the TTM's success and popularity in other areas of behavior modification, it seemed likely that it might be successful in promoting good oral health in chronic periodontitis patients.

Relationship between stages of change and processes of change

Processes of change include activities related to thinking and emoting about adopting good oral hygiene and behaviors hypothesized to be helpful for a comprehensive oral hygiene regimen. As suggested by Devet, the type of health behavior under study, for example, a "continuous behavior" needs to be performed repeatedly, to obtain the desired result.^[29] Similarly, changing an oral hygiene behavior involves several actions to be taken and requires continuous effort because the changes need to be performed repeatedly. Thinking and doing processes are important throughout all stages of behavior change when it involves adopting a positive behavior. Our study showed a significant difference in the process of change for different groups. Highest score of the process of change was seen in maintenance group and it gradually reduced as it proceeded to precontemplation stage. This implies that the people who were already brushing their teeth twice a day and those who wanted to brush twice daily in the near future had more positive attitude toward the benefits of maintaining their oral hygiene by brushing their teeth twice daily than those who were neither brushing twice a day nor interested in changing their brushing habits in the future. Similar observations were perceived in a smoking

cessation program, where smokers who had quit smoking after behavioral interventional program (TTM) had higher scores of the process of change than those of participants who continued smoking.^[30]

Relationship between stages of change and decisional balance

TTM suggests that in the early phases of change (i.e., precontemplation and contemplation), the cons outweigh the pros and that as one progresses through the stages, the pro's will outweigh the cons, and that this crossover point corresponds with a shift from the preparation stage to the action stage. Our study shows that the pro score in the decisional balance gradually increased from precontemplation to maintenance stages, whereas the cons score gradually decreased from precontemplation to maintenance stage. This states that the patients belonging to precontemplation stage could not balance their decisions about oral hygiene maintenance and hence did not brush their teeth twice a day. However, the interest toward the oral hygiene maintenance by brushing the teeth twice daily gradually increased from precontemplation to maintenance stage. A similar difference in decisional balance across the stages of interdental cleaning behavior change was noticed in senior high school students.^[31] In contrast, exercise behavior change in adolescents showed that the mean con scores for changing exercise behavior were similar for precontemplation, contemplation, and preparation stages.^[32]

Relationship between stages of change and self-efficacy

Higher mean self-efficacy score was recorded in maintenance group followed by action group, preparation group, contemplation group, and precontemplation, respectively. This indicates that the confidence levels in the maintenance group of patients were much higher in performing their oral hygiene regimen compared to the other four groups. A similar outcome was obtained with the interdental cleaning behavior among the high school students.^[11]

Comparison of measures of transtheoretical model measures with compliance to the periodontal treatment

When all the five groups were compared, statistically higher mean number of appointments attended was recorded in maintenance group followed by action group, preparation group, contemplation group, and precontemplation group, respectively. This suggests that the patients who were already under good maintenance phase were more compliant to the periodontal treatment compared to the other groups. Consequently, the compliance rate gradually decreased from maintenance to the precontemplation stage. This ascertains that TTM is applicable to evaluate the compliance of the periodontitis patients to the suggested periodontal treatment. Further, after the required counseling sessions on oral hygiene and plaque control, the TTM model can be reapplied to see the improvement rate in the compliance among the patients. Thus, TTM can assess patient's present attitude toward a healthy behavior and also helps to modify their behavior toward a more positive side than his/her present status.

Self-report adds an inherent, yet unavoidable, element of bias in the study. This form of self-administered questionnaires allows possible misinterpretation of questions by subjects and thus it could affect the results. In addition, social biases could have been evident as participants to give certain answers.

Within the limitations of our study, as per the results obtained, we can conclude that TTM can be used as an interventional assessment and strategy to improve the compliance of the patients to periodontal treatment.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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