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Effectiveness of an Integrated Behaviour Change Model to Enhance Sense of Coherence and Oral Health Status among School Students in Chennai City – An Interventional Study

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Abstract

Aim: To evaluate the effectiveness of an Integrated Behaviour Change model in enhancing Sense Of Coherence and oral health status among school students in Chennai city. **Materials and Methods:** 200 school children aged 13-15 years, were randomly allocated into the study and control group. The Integrated Behaviour Change Model was used to improve students' Sense of Coherence and Oral Health Status in the study group. Students in the control group received conventional oral health education using lecture method, peer teaching and audio-visual method. The Sense of Coherence of students in the study group was recorded using the 13-item Scale and Simplified Oral Hygiene Index (OHI-S), Gingival Index (GI) and Plaque Index (PlI) were used to assess Oral Health Status. Oral Health Belief was also recorded. After six months, Oral Health Status and Oral Health Beliefs were assessed. Sense Of Coherence of students in the study group was assessed. **Results:** The per cent decrease in the OHI-S score was 51% in the study group and 36% in the control group (p=0.001). PlI scores showed 66% and 63% reduction in the study and control group, respectively. After six months, the Oral Health Belief in the study group increased by 59% and the control group showed a 51% increase (p=0.013). Sense Of Coherence score showed a 10% increase in the study group. Further, improvement in the OHI-S score was found to be associated with the Sense Of Coherence score of students in the study group. **Conclusion:** The intervention established in this study improved the Sense Of Coherence and Oral Health Status of school students. The improvement in Oral Health Status obtained in the study group was higher than in the control group.

Keywords: Oral Health Belief, Oral Health Promotion, Oral Health Status, School Children, Sense of Coherence

1. Introduction

At present, Non-Communicable Diseases (NCDs) are an emerging pandemic with alarmingly high rates in developing countries[1]. Predominantly, NCDs are caused by four behavioural risk factors that are common aspects of economic transition and present-day lifestyle: use of tobacco, unhealthy diet, lack of physical activity and alcohol use[2]. These risk factors are also common for oral diseases and reported estimates suggest that, globally, 90% of individuals have experienced oral diseases in their lifetime[3].

The NCDs have become an important driver to the downward spiral resulting in reduced productivity, and increased cost for health care, driving families into poverty and stifling development[4]. These risk factors can be less harmful if addressed earlier in life when habits are not completely formed. Reducing risk factors for NCDs, particularly during adolescent years, provides the correct circumstances for superior health, increased years of productivity and reduced healthcare expenditure[5]. The world has the largest cohort of young individuals – 1.8 billion. And 1.5 billion of these, are living in developing countries. Adolescent years are possibly the best

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opportunity to cultivate optimistic habits of health and prevent harmful ones[5].

Age, gender, awareness, socioeconomic status and availability of oral hygiene aids are drivers of oral hygiene practices which are formed during adolescence and are expected to be practised for the rest of their lives making them the target group for oral health promotion[6]. Oral health behaviour is dependent on factors such as attitude, lifestyle, stress, level of education, feeling of coherence and self-efficacy[7].

During the last 30 years, various theories have explained the importance of social context and its relation with biological and psychological determinants of health and illness[8]. One such theory that has been proposed and that holds promise in health promotion, including oral health promotion is the Salutogenic theory proposed by Aaron Antonovsky in 1979 [9]. This theory emphasizes the role of psychosocial determinants of human well-being, i.e., the pathway and mechanisms leading to health, than focusing on the pathogenesis of disease[10]. According to Antonovsky, health is viewed as a movement between ease and disease, on an axis. The focus is on what promotes health and traces the origin of health[11].

Stress factors are innate to human beings, but an individual's internal and external resources enable them to face it and maintain health. This theory consists of two components: Sense Of Coherence (SOC) and General Resistance Resources (GRR)[12].

An individual's Sense Of Coherence (SOC) is, " *a global orientation that expresses the extent to which the person has a pervasive, enduring but dynamic feeling of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable and explicable; (2) the resources (General Resistance Resources- GRR) are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement*"[13].

The General Resistance Resources (GRR), can be present both in the immediate and the remote surroundings of a person, which include strategies of coping, social welfare, religion, cultural distinctiveness and preventive health orientation[13]. These set of life experiences can gradually enhance Sense Of Coherence (SOC) [14].

Sense Of Coherence encompasses, Comprehensibility – the level to which an individual understands the stressors they encounter (Cognitive component), Manageability – the level to which an individual considers their resources are appropriate to meet their requirements or demands (behavioural component) and Meaningfulness – the extent to which an individual understand and try to find meaning in the challenges and overcome them (motivational component). These three components are closely associated but exist as three different and individual concepts[13,15].

Individuals with stronger SOC cope with their stress more efficiently and maintain health. Sense Of Coherence influences people's movement towards the healthy end as it is the main determinant of people's position on the ease/disease continuum. Additionally, it may influence behaviour that can reduce the severity of the disease. Sense Of Coherence is related to increased dental attendance, frequency of tooth brushing, better Oral health Behaviour and Oral Health Status[14-16].

Sense of Coherence develops during childhood. Hence, improving SOC during adolescence can have a greater impact on oral health behaviour, as it is still in the formative stage[9]. Conventional dental health education programmes have shown an increase in knowledge for a brief period, but its influence on clinical outcomes is limited because they are not based on any theory and their focus is on knowledge, attitude and beliefs. For sustained improvement in oral health, behaviour changes along with psychological, individual, social and environmental factors that determine oral health are to be managed with multiple interventions[17].

Since every psychological theory or model is restricted in its approach, one possible way for improvement is to develop multidimensional models, as demonstrated by the Integrated Model (I – I-Change Model) to improve oral health[18]. Previous studies used cross-sectional design to assess the Sense Of Coherence and oral health of adolescent children with very few longitudinal studies and interventional studies. To verify a cause-effect relationship between Sense Of Coherence and oral health indicators, this interventional study was designed to evaluate the effectiveness of an Integrated Behaviour Change Model to enhance Sense Of Coherence and Oral Health Status among 13–15-year school students in Chennai city.

2. Materials and Methods

An interventional study was planned for 6 months among 13–15-year-old students in a school-based setting. Ethical clearance was issued by the Institution Review

Board of the Principal Investigator's affiliated institution. Permission to proceed with this study was obtained from the principal of the school, where the study was planned.

Inclusion criteria

1. Children between 13–15 years of age
2. Children with OHI-S baseline score between 1.3 – 3.0.
3. Children without any apparent systemic illness/disease.
4. Children with completely erupted index teeth (Tooth #16, 11, 12, 24, 26, 36, 32, 31, 44, 46).

Exclusion criteria

1. Children who did not get consent from parents.
2. Children with enamel defects like amelogenesis imperfecta, enamel hypoplasia and dental fluorosis.
3. Children with acute dental infections.
4. Children who underwent/undergoing orthodontic treatment.
5. Children who underwent oral prophylaxis/restoration three months before the start of the study.
6. Children with visual/hearing impairment.
7. Children diagnosed with cognitive disability.

Questionnaire validation

Prior to the study, the 13–item Sense Of Coherence Scale was validated. The English version of the 13-item Sense Of Coherence scale was translated into Tamil. The validity of the Tamil version was verified by the Back Translation Method, involving blind retranslation into English. Experts in both languages verified the validity of the translation. The internal consistency was checked and a Cronbach α value of 0.784 was obtained[19]. A pretested Oral Health Belief (OHB) questionnaire was used. Before the start of the study, the chief investigator underwent one week of training on the concept of Salutogenesis and behaviour change models.

Sample size calculation and allocation

The sample size for the study was calculated using G-Power sample size calculation software, version 3.0.10. Effect size d = 0.398 (calculated from previous study[20]), Power = 80%, α error = 5% and an allocation ratio of 1, the sample size was calculated to be 100 in both the study and control group.

A total of 300 students, aged 13–15 years were screened in the school premises. 248 students who fulfilled the inclusion and exclusion criteria were identified. From these, 200 students were selected and allotted randomly between the study and control groups.

Intervention

The Oral Health Status of students in both the study and control groups were assessed, at baseline and post-intervention, using the Simplified Oral Hygiene Index, Gingival Index and Plaque Index. Data regarding Oral Health Beliefs was collected using a pre-tested questionnaire. The Sense Of Coherence of children in the study group was assessed using the 13-item Sense Of Coherence Scale. Intervention A was given in the form of oral health education, which aimed to improve the Sense Of Coherence of students in the study group. In the control group, students were given oral health education using conventional methods - lecture method, peer teaching and audio-visual method (Intervention B) to improve Oral Health Status. After baseline examination, the interventions were given in the first, second and third months. Post-intervention, oral health status was assessed after three months, using OHI-S, GI and PlI indices. Sense Of Coherence of students in the study group was measured.

The Oral Health Beliefs were also assessed using a questionnaire consisting of six items about diet, oral hygiene practices, use of fluoride and dental visits to be answered on a four-point Likert scale ranging from 'Extremely important' to 'Not at all important'. The score ranges between 6 to 24. Better Oral Health Belief is indicated by higher scores. The Sense Of Coherence score of students in the study group was assessed using the 13-item Sense Of Coherence scale, on a 7-point Likert scale ranging from 1 to 7. The questionnaire consists of five questions on comprehensibility, four questions on manageability, and four questions on meaningfulness and the score ranges from 13 to 91. Higher scores represent a better Sense Of Coherence.

Intervention A (Enhancement of Sense Of Coherence)

1st Month Intervention: The intervention was aimed to enhance the comprehensibility component of Sense Of Coherence, understanding and awareness of oral health by describing a healthy oral cavity and its importance. The students were detailed about the parts of teeth, different dentition types, the function of teeth, various dental diseases like dental caries, gingivitis, periodontitis, malocclusion, pernicious habits, the damaging role of unhealthy diet and oral hygiene methods to reduce the

accumulation of plaque. The students were encouraged to think and discuss about the importance of healthy teeth.

2nd Month Intervention: The intervention was based on the manageability component of the Sense Of Coherence to enhance self-esteem, efficacy and confidence. The brushing technique and flossing technique were demonstrated with the help of a psychologist to boost their efficacy and confidence, student volunteers were encouraged to demonstrate the brushing technique to peers.

3rd Month Intervention**:** The intervention was based on the third component of Sense Of Coherence – meaningfulness, to enhance their belief that they can control their lives. Students were encouraged to assess their oral health and make plans to improve it. The session helped the children to develop a positive attitude and provided an opportunity for them to brainstorm, plan and implement a teaching programme for students of lower grades. Using charts and posters, students from the intervention group discussed the significance of maintaining oral hygiene and demonstrated plaque control methods to lower-grade students

Intervention B (Oral health education by conventional methods)

Oral health education was provided by the chief investigator comprising three sessions (40-45 minutes) spread over three months.

In the lecture method (1st-month), the chief investigator lectured the students about parts of the tooth, different dentition types, the function of teeth, various dental diseases like dental caries, gingivitis, periodontitis, malocclusion, pernicious habits, the damaging role of unhealthy diet and oral hygiene methods to reduce the accumulation of plaque. With the help of school teachers, two students were identified from the comparison group (Group B) and trained by the chief investigator to provide oral health education during the 2nd-month intervention. These two students explained the significance of a healthy oral cavity and provided oral hygiene instructions to their peers. In the third session (3rd month), the oral health education was reinforced using audio-visual aids. Oral health education was delivered using PowerPoint presentations.

Statistics

Data obtained were transferred to an Excel sheet and appropriate tests were run using Statistical Package for Social Sciences software (SPSS version 20, USA). Variables that showed normal distribution were analysed using the Independent sample t-test and Paired t-test. Variables that were in non-normal distribution were analysed using Mann Whitney U test and Wilcoxon Sign Rank test. Chi-Square test and McNemar test were used to compare proportions. To test for any association between the independent and dependent variables, Simple Linear Regression was performed.

3. Results

Table 1 depicts the distribution of study participants based on age, parent's education and monthly family income. Chi-Square test confirmed that there was no statistically significant difference between the two groups at baseline based on demographic details.

Table 2 reveals that the mean per cent change in Oral Health Belief in the study group (59.70%) was more than the control group (51.63%) and this change was statistically significant (p = 0.013).

Table 3 reveals that there was a statistically significant difference (p = 0.001) in the mean per cent decrease in OHI-S score between the study group (51.2%) and the control group (36.2%), 6 months after the intervention.

Table 4 reveals no statistically significant difference in the mean per cent change in the PlI score between the two groups.

Table 5 reveals no statistically significant difference in the mean per cent change in the GI scores between the two groups, 6 months after the intervention.

Table 6 reveals an increase in the Sense Of Coherence score after 6 months in the study group and the mean per cent increase in the Sense Of Coherence score was statistically significant (p = 0.001).

Table 7 shows the correlation between the per cent change in Sense Of Coherence and Simplified Oral Hygiene Index, Plaque Index and Gingival Index scores of study participants in the intervention group. Per cent decrease in Simplified Oral Hygiene Index score revealed a correlation with a per cent increase in Sense of Coherence (r= -0.225) and was found to be statistically significant (p=0.024).

Figure 1 shows the correlation between the per cent increase in the Sense Of Coherence and the per cent decrease in the Simplified Oral Hygiene Index score among study participants in the intervention group (regression equation obtained was y = 0.015x -1.13).

Table 1. Baseline demographic details of study participants

S. No.	Variable		Intervention Group	Control Group	p-value
1.	Age	13 Years	46	47	0.942#
		14 Years	50	48	
		15 Years	4	5	
2.	Mothers' Education	Illiterate	5	6	0.360#
		Primary School	9	11	
		Middle School	23	29	
		High School	34	37	
		Intermediate	9	3	
		Ug/Pg	20	13	
		Professional	0	1	
3.	Fathers' Education	Illiterate	4	8	0.222#
		Primary School	11	10	
		Middle School	10	13	
		High School	42	48	
		Intermediate	13	9	
		Ug/Pg	20	10	
		Professional	0	2	
4.	Monthly Family Income	≤-1800	2	0	0.718#
		1800-5400	17	18	
		5400-9000	24	24	
		9000-13500	33	36	
		13500-18000	16	17	
		18000-36000	8	5	

#Chi-Square Test

Table 2. Mean Oral Health Belief (OHB) score of study participants

Variable	Mean (S.D)		p-value
	Intervention	Control	
Oral Health Belief at Baseline	13.8(1.9)	14.3(2.2)	<0.089$
Oral Health Belief at Follow-Up (After 6 Months)	21.8(1.7)	21.3(2.0)	0.054$
Mean Per cent Change in Oral Health Belief	59.70(20.37)	51.63(25.09)	**0.013$**
p-value	**<0.001#***	**<0.001#***	

$Independent T-test, #Paired T-test, * p-value ≤ 0.05

Table 3. Simplified Oral Hygiene Index (OHI-S) scores of study participants

Variable	Mean (S.D)		p-value
	Intervention	Control	
OHI-S at Baseline	2.05(0.58)	1.66(0.45)	**<0.001$***
OHI-S at Follow-up (After 6 months)	0.98(0.45)	1.02(0.35)	0.544$
Mean Per cent Change in OHI-S	51.2(17.81)	36.2(22.80)	**<0.001$***
p-value	**<0.001#***	**<0.001#***	

$Independent T-test, #paired T-test, * p-value ≤ 0.05

Table 4. Plaque Index scores (PlI) of study participants

Variable	Mean (S.D)		p-value
	Intervention	Control	
Pl At Baseline	1.18(0.19)	1.07(0.11)	**<0.001**[*$]
Pl At Follow up (After 6 Months)	0.40(0.20)	0.39(0.24)	0.566[$]
Mean Per cent Change in Pl	66.1(17.13)	63.1(21.54)	0.564[$]
p-value	**<0.001**[#*]	**<0.001**[#*]	

[$]Mann Whitney test, #Wilcoxon signed rank test, * p-value ≤ 0.05

Table 5. Gingival Index scores (GI) of study participants

Variable	Mean (S.D)		p-value
	Intervention	Control	
GI at baseline	0.48(0.41)	0.24(0.13)	**<0.001**[$*]
GI at follow-up (after 3 months)	0.21(0.19)	0.12(0.05)	**0.001**[$*]
Mean Per cent Change in GI	34.48(43.60)	39.03(34.38)	0.786[$]
p-value	**<0.001**[#*]	**<0.001**[#*]	

[$]Mann Whitney test, #Wilcoxon signed rank test, * p-value ≤ 0.05

Table 6. Sense Of Coherence score (SOC) of participants in the study group

Variable	Mean (S.D)
Sense Of Coherence at Baseline	52.7(8.1)
Sense Of Coherence at Follow-Up (After 6 Months)	57.3(7.4)
Mean Per cent Increase in Sense Of Coherence	10.51(16.21)
p-value	**<0.001**[#*]

[#]Paired T-Test, * p-value ≤ 0.05

Table 7. Correlation between per cent change in the Sense Of Coherence (SOC) and Simplified Oral Hygiene Index, Plaque Index and Gingival Index of study participants in the study group.

Variable	Correlation	p-value
Per cent decrease in OHI-S	-0.225	**0.024***
Per cent decrease in GI	-0.084	0.406
Per cent decrease in Pl	-0.151	0.133

*Correlation is significant at the 0.05 level

4. Discussion

An intervention based on Sense Of Coherence was applied in this study, due to its multidimensional outlook and that it takes into consideration environmental and psychological factors. This principle could provide a structure for oral health promotion. Experiences of childhood and adolescence, social roles and work are decisive factors that affect the strengthening of Sense Of Coherence[9].

The intervention used in this study aimed to increase the Sense Of Coherence of participants in the study group and thereby decrease measures of oral health status. Post-intervention evaluation revealed that the per cent decrease in the Simplified Oral Hygiene Index score of participants in the study group was more than those in the comparison group. This decrease coincided with the per cent increase in the Sense Of Coherence score in the study group and the regression model confirmed the same.

The stability of a Sense Of Coherence in middle to late adolescence was demonstrated by a longitudinal study conducted over eighteen months[21]. The Integrated Model, outlined by Ayo-Yusuf was used in this study as it incorporates insights from multiple behaviour change theories. According to this model, the role of awareness, attitude, intention and self-efficacy are considered as important factors that determine behaviour change[18].

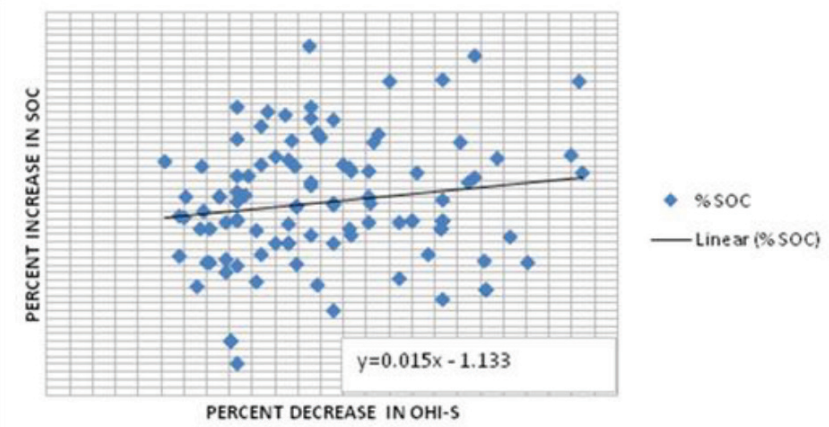


Figure 1. Correlation between a per cent increase in SOC and a per cent decrease in OHI-S among study participants in the intervention group.

Improvement in the Sense Of Coherence in turn influences the cognitive, motivational and behavioural components of an individual which coincide with awareness and intention described in the Integrated Model. Improving self-efficacy increases the manageability component of Sense Of Coherence, thereby enabling an individual to acquire skills to perform specific behaviour[18].

The first month's intervention aimed to make the study participants think positively about their oral health. Acquiring information results in the adoption of a healthy lifestyle, positive attitude and favourable behaviour[22] which are an integral part of health promotion[23]. Being detailed about various concepts of oral health, participants discussed the importance of maintaining healthy teeth and thus may have improved their Sense Of Coherence by enhancing comprehensibility.

The second-month intervention focused on improving participants' self-esteem and self-efficacy. Teaching brushing and flossing techniques provided them with the skill to perform the task thereby improving the manageability component of Sense Of Coherence. Antonovsky considered self-esteem as important for manageability. Developing an individual's health behaviour can be aided by improving self-esteem. Favourable oral health status can be due to high self-esteem. A study investigating the oral health status of 192 patients from a private dental clinic in Hong Kong showed that participants with high self-esteem had better oral health status[24].

A study was carried out among 611 Turkish pre-adolescents to assess the relationship between self-efficacy and oral health status, oral health behaviour and dental attendance. A dental examination and a self-administered questionnaire were used for collecting data. The results revealed that self-efficacy was related to oral health and oral health behaviour ($p<0.05$) [25].

The third month of intervention ensured active participation and empowerment of the study subject which resulted in the expression of their understanding in the form of posters, drawing, and writing to teach other students and thereby plan projects towards a healthy school environment. The participants represented that confectionaries should not be sold within the school campus. These activities ensured improvement in all three components of Sense Of Coherence.

The increase in Sense Of Coherence was similar to results obtained by Nammotri *et al.*,[20] wherein the Sense Of Coherence of participants in the study group was 6.39 times higher than the control group and thus exhibited better Oral Health Belief and normal gingiva.

4.1 Limitations of the Study

The effect of the intervention was observed till 6 months therefore further research is required to assess its long-term effect. The influence of the Intelligent Quotient (IQ) on the Sense Of Coherence of study participants was not assessed. Further testing is required in different settings.

5. Conclusion

An interventional study was undertaken to assess the effectiveness of an integrated behaviour change model to enhance Sense Of Coherence and oral health status among 1–15-year school children in Chennai city. The results revealed a negative association between the Simplified Oral Hygiene Index score and the Sense Of Coherence of participants in the intervention group. Improving the Sense Of Coherence of an individual can improve

oral health status and thus has the potential to make a significant contribution towards oral health promotion.

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