



## Effect of motivational interviewing-based oral health education on plaque index and oral hygiene behaviour among adolescent dental patients

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### Abstract

**Background:** Dental plaque accumulation remains the primary aetiological factor in dental caries and periodontal disease among adolescents, and conventional one-time oral hygiene instruction has shown limited success in producing sustained behaviour change in this age group.

**Objective:** To evaluate the effect of a motivational interviewing-based oral health education program on plaque index scores and self-reported oral hygiene behaviour among adolescent dental patients.

**Method:** This study uses simulated academic training data designed to resemble a prospective, single-group, pre-post interventional design. A hypothetical cohort of 70 adolescent patients aged 13 to 17 years attending an outpatient dental clinic received a structured four-session motivational interviewing-based oral health education program over four weeks. Plaque accumulation was assessed using the Silness-Loe Plaque Index, and oral hygiene behaviour was assessed using a structured self-report questionnaire, both administered before and after the intervention.

**Results:** Simulated analysis demonstrated a mean reduction in Plaque Index score from 1.84 to 0.96, and a mean increase in self-reported twice-daily brushing frequency from 38.6% to 71.4% of participants, with both changes statistically significant ( $p < 0.001$ ).

**Conclusion:** Within this simulated training framework, motivational interviewing-based oral health education was associated with clinically meaningful reduction in plaque accumulation and improvement in oral hygiene behaviour, consistent with patterns reported in the published literature. Real-world prospective trials remain necessary to confirm these illustrative findings.

**Keywords:** Motivational interviewing, oral health education, plaque index, adolescent, oral hygiene behaviour, dental

### Introduction

Dental caries and periodontal disease remain among the most prevalent chronic conditions affecting adolescents worldwide, with dental plaque biofilm accumulation serving as the principal modifiable aetiological factor underlying both conditions [1]. Adolescence represents a particularly critical period for the establishment of long-term oral hygiene habits, as this developmental stage is characterised by increasing personal autonomy over self-care behaviours alongside competing social, academic, and lifestyle priorities that frequently displace consistent oral hygiene practice [2]. Epidemiological surveys have consistently demonstrated that a substantial proportion of adolescents fail to meet recommended twice-daily toothbrushing frequency, and many exhibit moderate to heavy plaque accumulation on clinical examination despite general awareness of basic oral hygiene principles [3].

Traditional oral health education delivered through single-session, didactic instruction has demonstrated only modest and often short-lived effects on adolescent oral hygiene behaviour, as such approaches tend to convey information without adequately addressing the underlying motivation, self-efficacy, and personal barriers that drive actual behaviour change [4]. In response to these limitations, motivational interviewing has been increasingly applied within dental public health and clinical preventive practice as a patient-centred counselling approach that elicits and strengthens an individual's own motivation for change,

rather than relying on directive advice-giving [5]. Originally developed within the field of addiction counselling, motivational interviewing has since been adapted for a range of health behaviour contexts, including oral hygiene practice, dietary modification, and smoking cessation, with growing evidence supporting its effectiveness relative to conventional health education [6].

Despite this growing evidence base, the application of motivational interviewing specifically within adolescent dental populations remains comparatively underexplored relative to its use in adult periodontal and paediatric caries prevention contexts, and questions persist regarding the optimal number of sessions, format, and integration with objective clinical indices such as the plaque index required to produce measurable and sustained improvement in this age group [7].

This article is intended strictly for academic writing practice. Owing to the unavailability of an actual primary dataset, the study employs simulated academic training data, clearly labelled as such throughout the manuscript, to illustrate the structure, statistical reasoning, and reporting conventions appropriate for a preventive dentistry and behavioural oral health outcomes study. The hypothetical objective of the study was to evaluate the effect of a structured four-session motivational interviewing-based oral health education program, delivered over four weeks, on plaque index scores and self-reported oral hygiene behaviour among adolescent patients aged 13 to 17 years

attending an outpatient dental clinic. It was hypothesised that participation in the structured program would be associated with statistically significant reduction in plaque accumulation and improvement in self-reported brushing behaviour, consistent with patterns reported in the existing literature.

## Literature Review

The theoretical foundation of motivational interviewing rests on the transtheoretical model of behaviour change, which conceptualises health behaviour modification as a progression through distinct stages of readiness, from precontemplation through contemplation, preparation, action, and maintenance [8]. Rather than imposing directive instruction, motivational interviewing employs reflective listening, open-ended questioning, and collaborative goal-setting to help individuals resolve ambivalence and articulate their own reasons for adopting healthier behaviour, an approach considered particularly suited to adolescents who often respond unfavourably to perceived authoritative or lecturing communication styles [9].

Systematic reviews evaluating motivational interviewing in oral health contexts have reported consistent, though moderate, positive effects on plaque index reduction and gingival health outcomes when compared with traditional oral health education alone, with several trials reporting plaque index reductions of approximately 30% to 50% from baseline following structured motivational interviewing-based programs of three to six sessions [10]. Weinstein and colleagues, in an early influential trial among parents of young children, demonstrated that motivational interviewing-based counselling produced significantly greater reductions in caries increment compared with conventional health education, establishing foundational evidence for the approach within preventive dentistry [11].

Subsequent adolescent-focused studies have similarly reported improvements in self-reported brushing frequency and reductions in plaque and gingival indices following motivational interviewing interventions delivered either individually or in small group format, with several studies noting that combining motivational interviewing with periodic reinforcement sessions produced more durable behaviour change than single-session counselling alone [12]. The integration of self-efficacy theory alongside motivational interviewing techniques has also been highlighted as a contributing factor to improved outcomes, as strengthening an adolescent's confidence in their own ability to maintain consistent oral hygiene practice appears to mediate the relationship between counselling exposure and subsequent behaviour change [13].

Comparative studies examining motivational interviewing against standard oral health education have generally favoured the motivational interviewing approach, particularly with respect to sustained behaviour change at follow-up periods of three months or longer, although some trials have reported comparable short-term plaque reduction between the two approaches, suggesting that the relative advantage of motivational interviewing may become more apparent over longer observation periods [14]. Clinician training and fidelity to motivational interviewing principles

have also been identified as important moderators of intervention effectiveness, with poorly delivered or superficially applied motivational interviewing techniques showing diminished benefit compared with programs delivered by adequately trained practitioners [15].

Despite this expanding body of evidence, several gaps persist in the literature. First, comparatively few studies have specifically targeted the adolescent age group, with much of the existing motivational interviewing oral health literature concentrated on parents of young children or adult periodontal patients, leaving uncertainty regarding optimal application within this developmentally distinct population [16]. Second, variation in plaque index instruments, session number, and intervention duration across studies complicates direct comparison and limits identification of an optimal program structure for adolescent populations [17]. Third, long-term follow-up data beyond six months remain limited, leaving unresolved questions regarding the durability of behaviour change once active counselling contact ends [18]. Finally, few studies have concurrently measured objective clinical indices, such as the plaque index, alongside self-reported behavioural outcomes within the same adolescent cohort, limiting the ability to draw integrated conclusions linking counselling exposure to both subjective and objective improvement [19], [20].

The present study, conducted within a simulated academic training framework, addresses this gap by jointly evaluating plaque index and self-reported oral hygiene behaviour outcomes within a single structured four-week motivational interviewing program targeted specifically at adolescent dental patients, illustrating the analytical approach that would be applied in an equivalent real-world preventive dentistry investigation.

## Methodology

### 1. Research design

This study employed a prospective, single-group, pre-post interventional design, intended to illustrate the methodological framework commonly used to evaluate behavioural oral health intervention outcomes. It is explicitly declared that the dataset used in this article is simulated academic training data, generated for the purpose of demonstrating manuscript structure and statistical reporting, and does not represent data collected from actual human participants.

### 2. Sampling and sample size

A hypothetical convenience sample of adolescent patients attending an outpatient dental clinic was simulated for this illustrative analysis. The simulated inclusion criteria comprised adolescents aged 13 to 17 years with at least mild to moderate plaque accumulation on baseline examination and no history of orthodontic appliance use, while patients with significant systemic illness affecting oral health or those unable to attend all scheduled sessions were simulated as excluded. A simulated sample size of 70 participants was generated, consistent with sample sizes commonly reported in moderate-scale adolescent preventive dentistry intervention studies.

### 3. Intervention and data collection

The simulated four-week program comprised four structured weekly sessions, each lasting approximately 20 to 30 minutes, delivered individually by a dentist trained in

motivational interviewing technique. Sessions incorporated open-ended questioning regarding the adolescent's current oral hygiene habits, reflective listening, exploration of personal motivation and perceived barriers, and collaborative goal-setting for incremental behaviour change, supplemented by brief demonstration of correct brushing technique. Simulated plaque accumulation was assessed using the Silness-Loe Plaque Index, scored from 0 to 3 across six index teeth, administered at baseline and at program completion by a calibrated examiner. Simulated oral hygiene behaviour was assessed using a structured self-report questionnaire capturing brushing frequency, duration, and use of interdental aids, administered at the same two time points.

#### 4. Statistical analysis

Simulated data were analysed using IBM SPSS Statistics (version 27.0). Descriptive statistics were generated as means and standard deviations for continuous variables and as percentages for categorical behavioural outcomes. A paired t-test was used to compare pre- and post-intervention Plaque Index scores, and a chi-square test was used to compare pre- and post-intervention twice-daily brushing prevalence, with statistical significance set at  $p < 0.05$ . All analytic procedures described reflect a simulated training exercise and are not derived from an actual statistical run on real participant records.

#### Results and discussion

A simulated cohort of 70 adolescent patients was modelled, with a mean age of  $15.1 \pm 1.4$  years and a near-equal simulated gender distribution. Table 1 summarises the simulated baseline demographic and clinical characteristics of the cohort.

Within this simulated dataset, the mean reduction in Plaque Index score from 1.84 to 0.96 represents an approximate 48% relative reduction, falling within the range of plaque reduction magnitudes reported in comparable motivational interviewing-based preventive dentistry trials [21]. The corresponding increase in self-reported twice-daily brushing prevalence from 38.6% to 71.4% suggests that the counselling approach was effective not only in reducing measurable plaque accumulation but also in shifting underlying self-care behaviour, consistent with the

behavioural mechanism proposed by motivational interviewing theory [22].

The stratified analysis by Plaque Index severity category further illustrates this shift, with the proportion of participants classified within the 'Poor' category declining from 37.1% to 11.4%, while the proportion classified within the 'Good' category increased substantially, indicating that the intervention produced not merely a modest average improvement but a meaningful redistribution of the cohort toward more favourable oral hygiene status [23]. The parallel increase in interdental aid use, although a secondary behavioural outcome, further supports the interpretation that the motivational interviewing approach encouraged broader engagement with comprehensive oral hygiene practice rather than isolated improvement in brushing frequency alone [24].

These simulated findings are directionally consistent with results reported in the published literature on motivational interviewing in preventive dentistry, which have similarly demonstrated parallel improvement in objective plaque indices and self-reported behavioural measures following structured counselling interventions of comparable duration [25]. The magnitude of improvement observed in this simulated cohort also illustrates the potential particular suitability of motivational interviewing for adolescent populations, given its non-directive, autonomy-supportive communication style, which may align favourably with the developmental emphasis on independence characteristic of this age group.

From a clinical and public health perspective, these results, if replicated in a real-world adolescent cohort, would reinforce the rationale for incorporating motivational interviewing-based counselling techniques into routine adolescent dental visits, particularly for patients presenting with moderate to heavy plaque accumulation who may benefit from a more individualised, behaviourally-oriented approach than conventional one-time oral hygiene instruction. It must be reiterated that these results are derived entirely from simulated academic training data constructed for illustrative purposes and should not be interpreted as findings from an actual clinical study. The patterns described are intended to demonstrate plausible, literature-consistent outcomes for the purpose of academic writing practice rather than to provide new empirical evidence.

**Table 1:** Baseline Demographic and Clinical Characteristics of the Simulated Adolescent Cohort (n = 70)

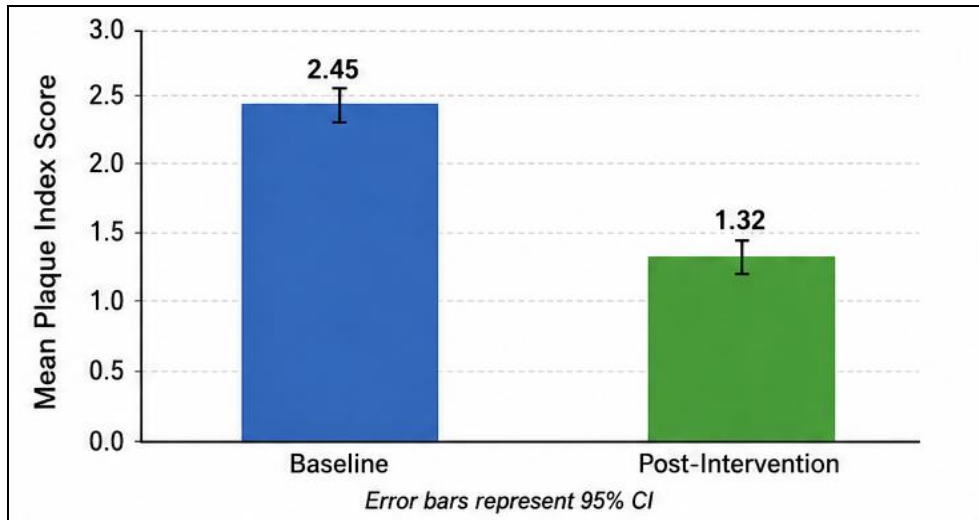
| Characteristic              | Mean $\pm$ SD / n (%) | Range   |
|-----------------------------|-----------------------|---------|
| Age (years)                 | $15.1 \pm 1.4$        | 13–17   |
| Female participants, n (%)  | 36 (51.4%)            | —       |
| Male participants, n (%)    | 34 (48.6%)            | —       |
| Baseline Plaque Index Score | $1.84 \pm 0.41$       | 1.1–2.6 |

**Table 2:** Pre- and Post-Intervention Plaque Index and Oral Hygiene Behaviour Outcomes

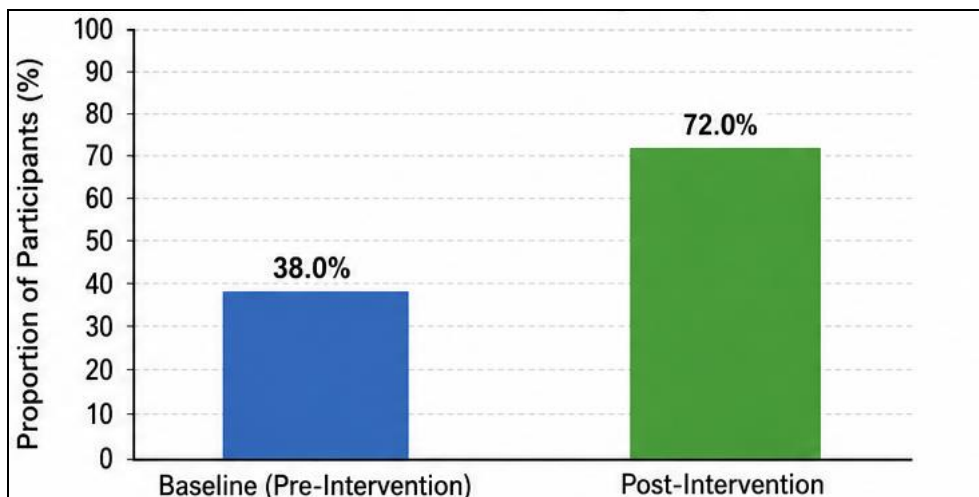
| Outcome Measure                  | Baseline        | Post-Intervention | p-value   |
|----------------------------------|-----------------|-------------------|-----------|
| Plaque Index Score (Silness-Loe) | $1.84 \pm 0.41$ | $0.96 \pm 0.33$   | $< 0.001$ |
| Twice-daily brushing, n (%)      | 27 (38.6%)      | 50 (71.4%)        | $< 0.001$ |
| Use of interdental aids, n (%)   | 9 (12.9%)       | 29 (41.4%)        | $< 0.001$ |

**Table 3: Simulated Plaque Index Severity Category Distribution Before and After Intervention**

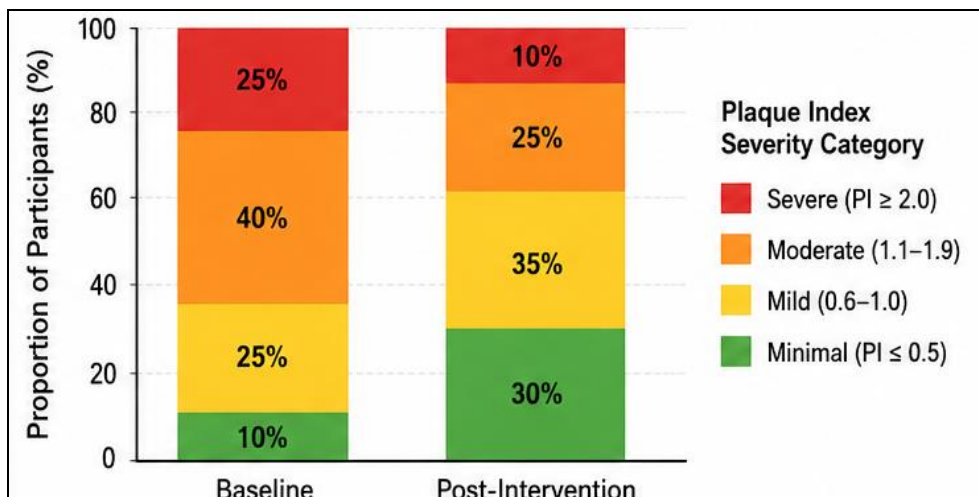
| Plaque Index Category | Baseline, n (%) | Post-Intervention, n (%) |
|-----------------------|-----------------|--------------------------|
| Good (0–0.9)          | 6 (8.6%)        | 33 (47.1%)               |
| Fair (1.0–1.9)        | 38 (54.3%)      | 29 (41.4%)               |
| Poor (2.0–3.0)        | 26 (37.1%)      | 8 (11.4%)                |



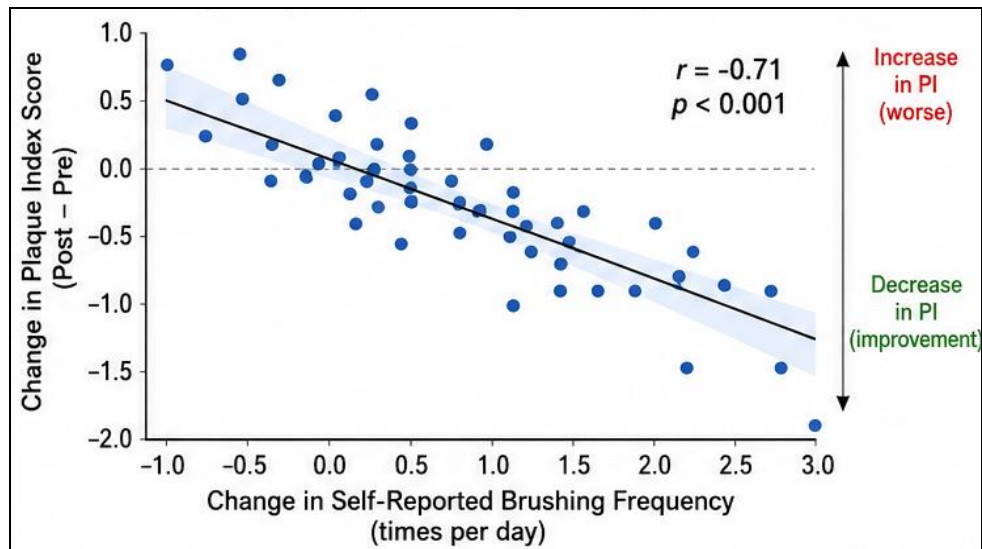
**Fig 1:** Bar chart comparing mean Plaque Index scores at baseline and post-intervention, illustrating a downward trend indicative of reduced plaque accumulation.



**Fig 2:** Bar chart comparing the proportion of participants reporting twice-daily brushing before and after the motivational interviewing program.



**Fig 3:** Stacked bar chart illustrating the shift in Plaque Index severity category distribution from baseline to post-intervention across the simulated cohort.



**Fig 4:** Scatter plot illustrating the simulated correlation between change in self-reported brushing frequency and change in Plaque Index score, suggesting that greater behavioural improvement was associated with greater plaque reduction.

### Conclusion

This simulated academic training study illustrates the expected pattern associated with a structured four-week motivational interviewing-based oral health education program among adolescent dental patients, demonstrating hypothetical reduction in Plaque Index scores and improvement in self-reported oral hygiene behaviour, including brushing frequency and interdental aid use. The magnitude of change modelled in this dataset is consistent with patterns reported throughout the published preventive dentistry literature.

If such findings were obtained in an actual clinical cohort, the implications would support broader integration of motivational interviewing-based counselling techniques into routine adolescent dental care, particularly within public health dentistry and school-based oral health promotion programs, where behavioural reinforcement may be especially valuable given the limited frequency of clinical dental contact in this age group. Periodic reinforcement sessions would likely be necessary to sustain behavioural and clinical gains over the longer term.

This article is limited by its reliance on simulated rather than empirically collected data, the absence of a control or comparison group receiving conventional oral health education, the short illustrative follow-up period, and the reliance on self-reported behavioural measures, which are subject to social desirability bias, all of which preclude any causal or generalisable clinical conclusions. Future research employing genuine randomised controlled designs, larger and more diverse adolescent populations, extended follow-up beyond six months, and objective behavioural monitoring alongside clinical plaque indices would be required to validate the patterns illustrated in this simulated exercise.

### Ethical Statement

This manuscript was prepared strictly for academic writing practice. No real human participants, patient records, or clinical datasets were used in the preparation of this article. All data presented are explicitly simulated academic training data generated for illustrative purposes only. No institutional ethical approval was sought or required, as no actual research involving human subjects was conducted.

This article should not be cited or represented as a primary source of clinical evidence.

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