





A COMPARISON BETWEEN TWO TECHNIQUES TO TREAT GUMMY SMILES IN ADULT PATIENTS WITH MAXILLARY DENTOALVEOLAR PROTRUSION: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Aim: The aim of the study was to compare two techniques for space closure in cases with protrusion and excessive display of the gingival on the quality of life of patients evaluated using OHIP-14 tool.

Methodology: 20 Adult females patient with class II Div 1 or bimaxillary protrusion were recruited to study. All cases has undergone leveling and alignment followed by extraction of 2 upper premolars. Pre-retraction OHIP-14 was administered at beginning of space closure. Absolute anchorage performed directly or indirectly was used for anchorage augmentation. Patients were seen regularly for 12-18 month until full space closure. Post-retraction questionnaire was administered and final records were taken.

Results: 20 adult females were included in the study and randomized equally to both intervention and comparator groups. No patients discontinued treatment or were lost in follow up. Regarding intra-group comparison, the 2 domains which showed improvement with treatment were the psychological and social disability, however it improving didn't show statistical significance. Inter-group comparisons between intervention and comparator group post-retraction and for retraction changes did not show any statistical significance result.

Conclusions: Miniscrews have been shown to be effective in achieving significant retraction and intrusion of anterior segment in cases with protrusion and gummy smile. An improvement in psychological and social disability score in OHIP-14 is expected with retraction and improvement of profile of adult females with protrusion.

KEYWORDS : Randomized Controlled Trial, Gummy smile, Protrusion, Oral-health related quality of life, OHIP-14

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INTRODUCTION

The definition of health by World Health Organization is now expanded, not only to affirm the absence of disease, but also to include a complete physical, mental and social well being. For medical and dental specialist in general and orthodontists in particular, this acceptance has placed far more weight on esthetics than on function and performance⁽¹⁾. Achieving a good harmonious smile is the primary objective of every orthodontist.^(2,3) The primary motivation behind seeking orthodontic treatment is often to address the psychosocial challenges associated with dental and facial appearance. These concerns go beyond mere aesthetics—they significantly impact an individual's quality of life. Orthodontics helps patients overcome what often feels like a social barrier. While clinical justifications are often emphasized, it's important to recognize that for many, having well-aligned teeth simply improves their day-to-day confidence and social experiences.^(4,5) Recent research supports the widely held belief that severe malocclusion can significantly affect social well-being. Correcting these dental issues has been shown to enhance self-confidence, boost self-esteem, and decrease instances of teasing and bullying.^(6,7) Previous research evaluated orthodontic treatment results was mainly focused on cephalometric parameters, dental models and smile esthetics⁽⁸⁻¹³⁾ with no or little direct patient value. Multiple recent studies had highlighted the importance of the use of patient related outcomes when evaluated different treatment techniques used in orthodontics. Many tools has emerged in the past 2 decades for detailed evaluation of different aspects of oral health related quality of life of our patients with variable validity and reliability. The most popular of these tools was the OHIP-14, which is a reduced version of the original Spencer OHIP-49 tool.^(14,15)

The aim of the present study was to compare two techniques for space closure in cases with protrusion

and excessive display of the gingival on the quality of life of patients evaluated using OHIP-14 tool.

METHODOLOGY

A randomized clinical trial with two parallel groups was conducted in the clinic of the orthodontic department in Faculty of Dentistry, Cairo University. Adult female patients with class II div 1 or bimaxillary protrusion and excessive display of gingiva were recruited. Subjects with history of previous orthodontics treatment, poor oral health that, cases requiring orthognathic surgery, were excluded from the study.

PS Power Software (PS Version 3.1.2) was used for sample size calculation. The calculation was based on a type I error probability set to 0.05 and a power of 0.8 to detect a significant difference if present. Data regarding amount of gummy smile measured in millimeters from previous thesis⁽⁷⁾ was used for sample size calculation and resulted in an effect size of 1.65. A total of 20 individuals were finally included in the study.⁽¹⁶⁾ Random sequence generation was done using random.org. Opaque sealed envelopes were used for allocation concealment. Only blinding of the assessor and statistician was possible, while blinding of operator was not possible because of nature of intervention.

Eligible patients were examined for any systemic disease and any dental pathology. The purpose of the study and the details of the intervention and control were explained to the patient, then they were asked whether they want to participate in the study and consequently signed an informed consent. Full set of records (study models, lateral cephalometric radiographs, extra-oral and intra- oral photos) were taken for every patient as part of the routine procedure for treatment of orthodontic patients. Bonding and banding was performed for all cases. Leveling and alignment with progressive arch wires was then performed until 17x25 SS could be placed in the brackets of all teeth.

Two infrazygomatic screws and two interradicular screws were placed in the intervention group and comparator groups respectively. After mini-screw insertion, the patient was then referred for the oral surgery department for extraction of upper and lower first premolars. Pre-retraction records including, cephalometric radiograph, extra-oral and intra-oral photographs and pre-retraction OHIP-14 questionnaire was taken. (Figure 1)

Retraction was done directly using power chain in the infrazygomatic group while indirect anchorage and power chain anchored on last molar were used in the other group. Every 6 weeks the patients were reviewed, stability of mini screws assessed and power chains were re-activated as shown in previous studies^(17,18). Retraction was continued till the canine became in contact with the upper second premolar or for a maximum of 18 months if full space closure

was not achieved. Post-retraction records similar to that taken before space closure was taken. This included post-retraction cephalometric radiograph, extra-oral and intra-oral photographs and post-retraction OHIP-14 questionnaire. (Figure 2)

Outcomes

The OHRQoL of patient was assessed at pre-retraction and post-retraction using the reduced version of OHIP-14. OHIP-14 was previously translated and validated in Arabic populations. The arabic and english version of the OHIP-14 questionnaire used in the study is presented in figures (43) and (44) respectively. The OHIP-14 questionnaire consist of 14 questions that constitutes 7 domains; psychological discomfort, functional limitation, physical pain, physical disability, social disability, psychological disability and handicap. Each 2 successive questions constitute one domain



Fig. (1) A typical case after extraction with mini-screws inserted. the patient is ready for acquiring of pre-retraction records (Photos, radiographs and patient questionnaire).



Fig. (2). A typical case after full space closure ready for post-retraction records.

and could be summed together to give an overall score for a specific domain. The questions and domains are arranged consecutively starting from the functional limitation domain and ending by the handicap domain. Each question takes an ordinal score from 0 to 5, where 0 refers to an event that never happened and 5 refers to an event that occurs very often. The 14 questions were summed together to give an overall OHIP-14 score for each patient. (Figure 3)

Statistical Analysis

Baseline data of the patients including the age, gender, various clinical and cephalometric parameters were summarised using descriptive statistics; means, standard deviations, median, and ranges. Data was explored for normality using Shapiro-Wilk test. Comparative statistics using

student T test if data is normally distributed. Mann-Whitney and signed rank test were applied when T test assumption were not met. The significance level was set at $<5\%$ and all analyses were conducted using Medcalc software, version 22 for windows (MedCalc Software Ltd, Ostend, Belgium).

RESULTS

Analysis of the data of OHIP-14 domains revealed non-normal distribution. Hence, in addition to mean and standard deviation (SD), also median and interquartile range (IQR) for each of the seven domains of OHIP-14 is described in figure (4) and table (1).

Intra-group comparison of each of the intervention and comparator groups revealed non statistically significant change in the sum score of the

OHIP-14 Questionnaire

Please answer the following questions based on your experience in the last six months.

	Never	Hardly ever	Occasionally	Fairly often	Very often
1) Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?					
2) Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?					
3) Have you had painful aching in your mouth?					
4) Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?					
5) Have you been worried by dental problems?					
6) Have you felt tense because of problems with your teeth, mouth or dentures?					
7) Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?					
8) Have you had to interrupt meals because of problems with your teeth, mouth or dentures?					
9) Have you found it difficult to relax because of problems with your teeth, mouth or dentures?					
10) Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?					
11) Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?					
12) Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?					
13) Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?					
14) Have you been totally unable to function because of problems with your teeth, mouth or dentures?					

Fig. (3). The OHIP-14 questionnaire used to assess OHRqoL.

TABLE (1). Descriptive statistic of OHIP-14 in both groups pre-retraction and post-retraction

Variable			Pre-retraction	Post-retraction	Mean Difference
Functional Limitation	Intervention Gp	Median(IQR)	0.5 (0 to 2)	1 (0 to 1)	0 (0 to 0)
		Mean(SD)	1.38 (2.06)	1 (1.07)	-0.38 (1.67)
	Comparator Gp	Median(IQR)	0 (0 to 1.5)	0 (0 to 2)	0 (0 to 0)
		Mean(SD)	0.75 (1.16)	0.662(1.06)	-0.12(0.35)
Physical Pain	Intervention Gp	Median(IQR)	4 (1.5 to 5)	4.5 (1 to 6)	0.5 (0 to 1)
		Mean(SD)	3.38 (2.2)	3.75 (2.76)	0.37 (0.74)
	Comparator Gp	Median(IQR)	4 (3 to 5)	4 (3 to 5)	0 (-0.5 to 0.5)
		Mean(SD)	3.75 (2.0)	3.75 (1.20)	0 (0.74)
Psycholo-gical Discomfort	Intervention Gp	Median(IQR)	1 (0 to 2)	1 (0 to 2.5)	0 (0 to 0.5)
		Mean(SD)	1.13 (1.25)	1.25 (1.39)	0.12 (1.13)
	Comparator Gp	Median(IQR)	1 (0 to 2.5)	1 (0 to 1.5)	0 (-1 to 1)
		Mean(SD)	1.38 (1.51)	1.13 (1.35)	-0.25 (1.91)
Physical Disability	Intervention Gp	Median(IQR)	2 (1.5 to 3.5)	3 (1.5 to 4)	0 (0 to 1)
		Mean(SD)	2.38 (1.6)	2.75 (1.67)	0.37 (0.52)
	Comparator Gp	Median(IQR)	2 (0 to 3)	1.5 (0 to 4)	0 (-0.5 to 1)
		Mean(SD)	1.75 (1.67)	1.88 (1.89)	0.13 (1.25)
Psychological Disability	Intervention Gp	Median(IQR)	2.5 (2 to 3)	2 (0.5 to 3)	-0.5 (-1.5 to 0.5)
		Mean(SD)	2.75 (1.48)	2.25 (2.25)	-0.50 (1.20)
	Comparator Gp	Median(IQR)	3 (2 to 4.5)	1.5 (0 to 3.5)	-1.5 (-2.5 to 0)
		Mean(SD)	3.13 (1.55)	1.75 (1.75)	-1.38 (2.14)
Social Disability	Intervention Gp	Median(IQR)	2 (1 to 3.5)	1 (0 to 3)	-1 (-1 to 0)
		Mean(SD)	2.25 (1.67)	1.63 (1.92)	-0.63 (0.92)
	Comparator Gp	Median(IQR)	3 (2.5 to 3.5)	2 (0 to 3)	-0.5 (-2 to 0)
		Mean(SD)	2.88 (1.46)	1.75(1.67)	-1.13 (1.96)
Handicap	Intervention Gp	Median(IQR)	1 (0 to 3.5)	1 (0.5 to 2)	0 (0 to 0)
		Mean(SD)	1.75 (2.12)	1.50 (1.60)	-0.25 (1.17)
	Comparator Gp	Median(IQR)	2 (2 to 2)	1 (0 to 2)	-1 (-2 to 0)
		Mean(SD)	2.25 (1.67)	1.25 (1.39)	-1.00 (0.93)
SUM	Intervention Gp	Median(IQR)	14 (8 to 22)	15.5 (5 to 21)	0 (-4.5 to 2.5)
	Comparator Gp	Median(IQR)	16 (11 to 18)	11 (6.5 to 18.5)	-3.5 (-6 to 0)

OHIP-14 questionnaire. Inter-group comparison of each of the pre-retraction, post-retraction and retraction changes in SUM score of the OHIP-14 questionnaire are also non statistically significant. Comparative statistics with parametric or non parametric significance test of individual domains

was not performed because of the small sample size and the non normal distribution of the original data. Comparative statistics with reference to sum score of OHIP-14 didn't reveal any significant difference at all time points and is represented in table (2).

TABLE (2). Comparative Statistics of SUM OHIP-14 in both intervention and comparator groups.

	Mean	Intervention Gp			Comparator Gp			Mean Difference			
		SD	95% CI	Mean	SD	95% CI	Mean	SD	95% CI	P value	
Sum	Pre-retraction	15.00	9.37	7.17 to 22.83	15.88	6.98	10.04 to 21.71	-0.88	8.26	-9.73 to 7.98	P = 0.8352
	Post-retraction	14.13	10.47	5.37 to 22.88	12.13	8.64	4.90 to 19.35	-2.00	9.60	-12.29 to 8.29	P = 0.6832
	Post-Pre	-0.88	4.12	-4.32 to 2.57	-3.75	6.84	-9.47 to 1.97	2.88	5.65	-3.18 to 8.93	P = 0.3258
	P Value		P = 0.5671			P = 0.1649					

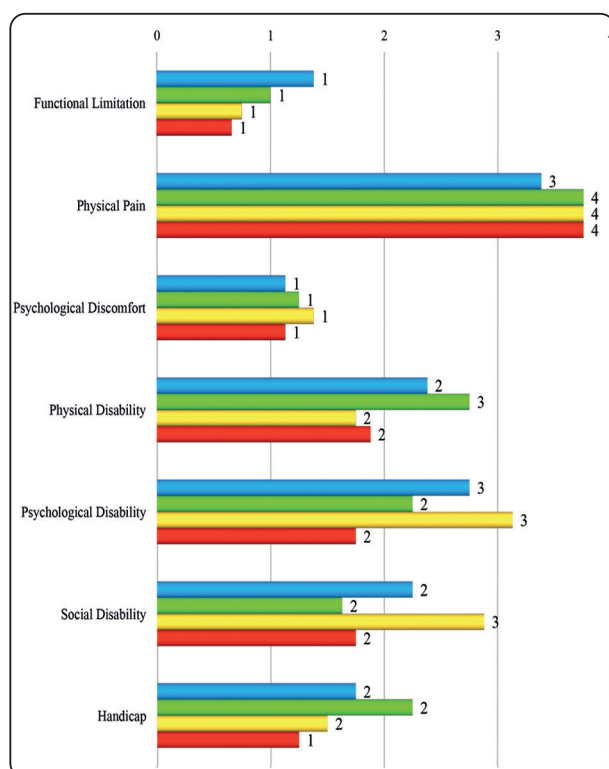


Fig. (4). Comparison of mean scores for each of OHIP-14 domains in intervention and comparator groups both pre-retraction and post-retraction.

DISCUSSION

Maxillary protrusion cases is the "bread and butter" of every orthodontist practice. This study has addressed a specific feature of these cases, the excessive gingival display that is very frequent, yet overlooked, in many of these cases.

Until fairly recently, the goal of health care was conceived as primarily the control of disease and infirmity. Orthodontists struggled for many years to fit "correction of malocclusion" within the confines of this narrow definition. Today, the concept of health is a state of complete physical, mental, and social well-being, and the goal of treatment now is to maintain and enhance the patient's quality of life. Procedures designed to elevate individuals beyond a state of normal health are often classified as enhancements. Given our inherently social nature, people are driven to present themselves well in the eyes of others. When dental appearance disrupts this interaction, it constitutes more than a cosmetic concern—it becomes a genuine social limitation. Orthodontic treatment is thus justified when

malocclusion leads to social or functional difficulties, not simply because of dental misalignment alone.

Hence, the use of the OHRQoL tool in evaluation of the effectiveness of treatment is essential. The oral health impact profile -14 (OHIP-14) is a reduced version of the original OHIP-49 Slide and Spencer in 1994⁽¹⁴⁾ introduced by Slade in 1997⁽¹⁵⁾. It is one of the most popular OHR-QoL assessment tools. The translation and validation of the arabic version has been published before Al- Habashneh et al. in 2012⁽¹⁹⁾ and Khalifa et al. in 2013⁽²⁰⁾.

Most of previous research evaluating Oral health related quality of life in orthodontics has only focused on presenting the results at the beginning of treatment and after the end of treatment. However, the intent of our present study was to shed some light on the change of OHIP-14 throughout treatment. Hence, two mid-treatment questionnaires were administered before and after space closure to study the change of oral health related quality of life independent from the presence of brackets. Thus the full picture of longitudinal change in OHIP-14 throughout treatment could be visualized.

Assessment of the results of OHIP-14 did not reveal significant difference with treatment or between the groups. One factor could explain the lack of significant findings is the sample size that is inadequately powered to detect this difference especially as related to the nature of data of OHIP-14 which are ordinal by nature and need much larger sample size compare to continuous data as the amount of gummy smile that was used for sample size calculation. Another reason could be that the OHIP-14 questionnaire was administered at the end of space closure rather than after debonding, as many of the domains of the OHIP-14 are much more sensitive to the presence of orthodontic brackets. The most relevant domain of the OHIP with regard to OHIP-14 are the last 3 domains; psychological discomfort, social disability and handicap. All showed a tendency for reduced scores with treatment however none was statistically significant.

Compared to previous research, a recent clinical trial Antoniazzi et al. (2017) compared the oral health related quality of life (OHRQoL) between subject with and without excessive gingival display.⁽²¹⁾ The cross sectional study was performed on 106 individuals and OHRQoL was assessed by Oral Health Impact Profile -14 (OHIP-14). The authors found that participants with excessive gingival display had higher OHIP-14 score and were less satisfied with their smile (78.9% vs 21.1%) compared to participants without excessive gingival display. Using multivariate regression analysis, it was found that the total OHIP-14 score were 2.1 fold higher in individuals with excessive gingival display, independent of other variables. The authors finally concluded that the occurrence of excessive gingival display had negative impact on the OHRQoL in this specific population.

Another clinical trial⁽²²⁾ evaluate the change of OHRQoL in adolescents with and without extraction. The evaluation was performed 1 month (T1), 3 months (T2), 6 months (T3) and 1 year (T4) after the start of orthodontic treatment and 1 week after completion of orthodontic treatment (T5). The study revealed that while both orthodontic treatment approaches led to a similar decline in OHRQoL, the recovery from these negative effects was slower among patients who underwent first premolar extractions.

CONCLUSIONS AND RECOMMENDATIONS

From the results of the clinical and statistical analyses, and within the limitations of this study, the following conclusions could be withdrawn:

1. The oral health related-quality of life as measured by the oral health impact profile-14 tool did not show a significant improvement in either group post-retraction when compared with its pre-retraction score.
2. Comparing the two groups at all time measures didn't reveal any significant different with regard to sum score of the OHIP-14.

3. OHR-QoL assessment should be mandatory outcome measures to be used in orthodontic research for evaluation the effectiveness of different clinical techniques.
4. Further research with larger sample size and various tools for measuring OHR-QoL should be encouraged.
5. Future research evaluating OHRQoL pre-treatment and post-treatment after removing of orthodontic brackets is necessary.

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