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Title of Master's Thesis

The effect of Chios' mastic mouthwash on halitosis and oral hygiene in orthodontic patients: a randomized clinical trial

Konstantina Tsironi

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Three-Member Committee for examination of Master's Thesis:

Iosif Sifakakis, Associate professor, Supervisor

William Papaioannou, Associate Professor, Member

Spyridon Vasilopoulos, Assistant Professor, Member

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Τίτλος Μεταπτυχιακής Διπλωματικής Εργασίας

Η επίδραση του στοματικού διαλύματος με μαστίχα Χίου στην κακοσμία και στοματική υγιεινή ασθενών υπό ορθοδοντική θεραπεία: τυχαιοποιημένη κλινική δοκιμή

Κωνσταντίνα Τσιρώνη

Αριθμός Μητρώου 201907

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Τριμελής Εξεταστική Επιτροπή

Ιωσήφ Σηφακάκης, Αναπληρωτής Καθηγητής, Επιβλέπων

Βασίλειος Παπαϊωάννου, Αναπληρωτής Καθηγητής, Μέλος

Σπυρίδων Βασιλόπουλος, Επίκουρος Καθηγητής, Μέλος

Το ερευνητικό πρωτόκολλο της παρούσας μελέτης, με αριθμό πρωτοκόλλου 461/12-03-2021, εγκρίθηκε από την Επιτροπή Δεοντολογίας Έρευνας του Τμήματος Οδοντιατρικής ΕΚΠΑ στη συνεδρίαση στις 10/6/2021.

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Περιεχόμενα/Contents

Περίληψη

Η κακοσμία του στόματος (χαλίτωση) αποτελεί συχνό φαινόμενο και διαχωρίζεται σε φυσιολογική ή παθολογική. Η πρώτη είναι σχετιζόμενη με τον ύπνο, το κάπνισμα, την κατανάλωση αλκοόλ ή έχει ορμονικό υπόβαθρο. Η παθολογική κακοσμία του στόματος προέρχεται κατά κύριο λόγο από τη στοματική κοιλότητα και οφείλεται στον μεταβολισμό των μικροβίων στις επιφάνειες της στοματικής κοιλότητας. Οι ασθενείς με ακίνητους ορθοδοντικούς μηχανισμούς είναι περισσότερο επιρρεπείς στην κακοσμία του στόματος λόγω της δυσκολίας στην αποτελεσματική στοματική υγιεινή. Η μέτρηση της κακοσμίας μπορεί να γίνει με τη χρήση τριών αντικειμενικών μεθόδων: οργανοληπτική μέθοδος, χαλιμετρία και αεριο-χρωματογραφία. Η τελευταία αποτελεί την πιο πρόσφατη μέθοδο αξιολογεί τη συγκέντρωση των τριών πιο συνηθισμένων πτητικών ενώσεων θείου (ΠΕΘ) που σχετίζονται με την κακοσμία. Αυτά είναι: το υδρόθειο (H_2S), η μεθυλ-μερκαπτάνη (CH_3SH) και το διμεθυλσουλφίδιο [$(CH_3)_2S$]. Σκοπός της παρούσας μελέτης ήταν να διερευνηθεί η επίδραση του στοματικού διαλύματος με μαστίχα Χίου στην κακοσμία του στόματος και στους δείκτες πλάκας και φλεγμονής σε ασθενείς υπό ορθοδοντική θεραπεία με ακίνητους ορθοδοντικούς μηχανισμούς. Η μελέτη ήταν μια προοπτική, διπλά τυφλή, ελεγχόμενη με εικονικό φάρμακο, τυχαιοποιημένη κλινική δοκιμή με δύο παράλληλες ομάδες. Τριάντα ασθενείς με ακίνητους ορθοδοντικούς μηχανισμούς κατανεμήθηκαν τυχαία σε αναλογία 1:1, είτε στην ομάδα μαστίχας είτε στην ομάδα εικονικού στοματικού διαλύματος. Όλοι οι συμμετέχοντες έλαβαν στοματικά διαλύματα για 2 εβδομάδες. Τα κριτήρια επιλεξιμότητας περιλάμβαναν ηλικίες μεταξύ 13 και 18 ετών, ενεργή ορθοδοντική θεραπεία με ακίνητους ορθοδοντικούς

μηχανισμούς, καλή γενική υγεία και συνολικά αρχικά επίπεδα ΠΕΘ πάνω από το επίπεδο των 150ppb: Οι μεταβλητές που αξιολογήθηκαν ήταν: (α) η κακοσμία μέσω των επιπέδων ΠΕΘ με τη συσκευή Oral Chroma^{TM}, (β) η υποκειμενική αντίληψη της κακοσμίας μέσω ερωτηματολογίων και (γ) η στοματική υγιεινή μέσω του τροποποιημένου δείκτη πλάκας (PI-M) και του δείκτη φλεγμονής (GI) τόσο κατά την έναρξη (T0) όσο και μετά από 2 εβδομάδες (T1). Στην ομάδα μαστίχας, τα επίπεδα υδρόθειου μειώθηκαν από 221,00ppb (T0) σε 125,00ppb (T1) και η διαφορά μεταξύ των θεραπειών ήταν στατιστικά σημαντική και υπέρ της ομάδας μαστίχας. Ωστόσο, οι διαφορές στα επίπεδα των άλλων δύο αερίων, της μεθυλ-μερκαπτάνης και του διμεθυλσουλφδίου, δεν ήταν στατιστικά σημαντικές. Οι δείκτες στοματικής υγιεινής παρουσίασαν μικρές διαφορές και στις δύο ομάδες, ενώ οι υποκειμενικές μετρήσεις της κακοσμίας του στόματος δεν παρουσίασαν διαφορές. Συμπερασματικά, τα στοματικά διαλύματα μαστίχας θα μπορούσαν να αποτελέσουν εναλλακτικό τρόπο ελέγχου πιθανής κακοσμίας του στόματος σε έφηβους ασθενείς κατά τη διάρκεια της ορθοδοντικής θεραπείας με ακίνητους μηχανισμούς.

Λέξεις κλειδιά: Χαλίτωση, Στοματικό διάλυμα, Μαστίχα Χίου

Abstract

The aim of this study was to investigate the effect of Mastic mouthwash on halitosis (Volatile Sulfur Compounds' levels, VSCs) as well as plaque and gingival indexes in patients undergoing orthodontic treatment with fixed appliances. The study was a double-blinded, placebo-controlled, parallel group, randomized clinical trial. Thirty patients with fixed orthodontic appliances were randomly allocated at a 1:1 ratio, to either the mastic-mouthwash or the placebo-mouthwash group. Eligibility criteria included ages between 13 and 18, active orthodontic treatment with fixed appliances, good general health and total initial VSCs levels above the baseline level of 150ppb.The primary outcomes were: (a) their subjective perception of their own malodor via questionnaires, (b) their objective VSCs levels (hydrogen sulfide (H_2S), methyl-mercaptan (CH_3SH) and dimethyl sulfide [$(CH_3)_2S$] through the Oral Chroma^{TM} device and (c) oral hygiene assessed with the use of the Modified Silness and Löe Plaque Index (PI-M) and the Silness and Löe Gingival Index (GI) at both baseline (T0) and after 2 weeks (T1). Stratification by gender randomization was implemented with two random sequences, one for each mouthwash, concealed in opaque numbered sealed envelopes. H2S level dropped from 221.00ppb (T0) to 125.00ppb (T1) and the difference between treatments was statistically significant and in favor of the mastic group (coef: 72.34, 95% CI: 8.48, 136.27, p=0.03). The reduction in the levels of the other VSCs did not differ between treatment arms. The oral hygiene indexes showed little differences in both groups whereas the subjective measurements of oral malodor did not show any differences. Mastic mouthwashes could be an alternative

treatment for adolescent patient suffering from halitosis during the orthodontic treatment with fixed appliances.

Keywords: Halitosis, Mouthwash, Chios' mastic

Introduction

Halitosis is the third most common oral condition perceived by the patients as pathologic, after caries and periodontal diseases [1]. The available epidemiologic studies estimate that 30-50% of the population experience oral malodor [2,3]. Halitosis can be categorized as physiologic and pathologic. Physiologic halitosis is quite common in the morning (also known as morning breath) and probably related to normal nocturnal hyposalivation and increased microbial metabolic activity during sleep [4]. It can also be the consequence of smoking or consumption of either alcohol or odiferous food and drinks and can also be aggravated by menstruation in women [5,6]. Pathologic halitosis most commonly (≅85%) originates from the oral cavity and is a result of bacterial deposits that cover the tongue or are found in the inflamed oral mucosa, under poor-quality restorations, orthodontic mechanisms, carious lesions or mucosal ulcers [7,8]. Odor usually results from the microbial degradation of organic substrates present in saliva [9-11]. This interaction generates malodorous volatile sulfur compounds (VSCs), of which the three most common are: hydrogen sulfide (H2S), methyl-mercaptan (CH3SH) and dimethyl sulfide [(CH3)2S] [12].

Orthodontic patients with fixed appliances are more prone to halitosis, due to the impaired oral hygiene and therefore increased plaque accumulation and increased amounts of available nutrients for the supragingival and subgingival microbes [13,14]. For the assessment of halitosis there are 3 objective measurements available: 1) organoleptic measurement, 2) halimetry (sulfide monitoring) and 3) gas chromatography. The organoleptic measurement is considered as the gold standard and could be performed directly by the investigator at a fixed distance by smell.

Alternatively, the patient may slowly breathe in a plastic tube and a calibrated examiner evaluates the smell coming out of the tube in a scale from 0 to 5. Halimetry is the assessment of halitosis through a sulfide monitor (HalimeterTM) where the patient exhales to a tube connected to the monitor. This monitor can measure the level of total VSCs. Gas chromatography (Oral ChromaTM) is a more recent method by which concentrations of the 3 VSCs can be quantified and also evaluated separately. Today, the second version of the OralChromaTM device (CHM-2) is the most widely used halitosis assessment device and offers more accurate VSCs measurements compared to the previous devices [15-17].

The patient exhale is imported to the device through a syringe and the compounds are compared and identified using a computer-based database [7,18]. According to the literature, the baseline level of total VSCs levels that determine halitosis is 150ppb (parts per billion; ppb) [18,19].

Interventions to control halitosis include either mechanical (tongue scrapers) or chemical methods (mouthwashes, chewing gums, toothpastes etc.) [20]. Recently different chemical agents have been used in the treatment of halitosis, including herbal oils, green tea, probiotics and plant extracts [21-23]. Chios' mastic (Pistacia Lentiscusvar. Chia) is the resinous secretion of the mastic tree (Pistacia Lentiscusvar. Chia). Several studies on the action of mastic and chewing gum of Chios' mastic have shown that it may reduce the formation of dental plaque, as well as inhibit bacterial growth in the oral cavity [24-26]. The effect of mastic mouthwash on orthodontic patients has not been previously studied. A randomized clinical trial was therefore planned to evaluate whether a common mastic mouthwash benefits halitosis and the impaired oral hygiene of orthodontic patients.

Specific objectives or hypotheses

The aim of this prospective, randomized, placebo-controlled, double-blind clinical study was to investigate the effect of Mastic mouthwash (Mastiha Mouthwash Gingivaction, Mastihashop®) on halitosis and plaque and gingival indexes in patients undergoing orthodontic treatment with fixed appliances. The research hypothesis was that the use of Mastic mouthwash during the orthodontic treatment did not affect the subjective perception of the oral malodor, the objective VSCs levels and the oral hygiene levels of the patients.

Materials and methods

Trial design

This trial was designed as a randomized, placebo-controlled, double blinded, superiority trial, with two parallel groups and a 1:1 allocation ratio. No changes to the methods occurred after trial commencement.

Participants, eligibility criteria, and setting

The study was conducted on patients undergoing orthodontic treatment with fixed appliances, treated by residents at the Department of Orthodontics. The duration of the study was two weeks and the following selection criteria were applied: aged 13 to 18 years old, with fixed conventional labial appliances on the maxillary and mandibular arch, brackets or bands at least on 24 teeth for more than 4 months before enrollment and estimated duration of the treatment more than 1 month, bands on the first molars, in extraction cases patients could be enrolled at least two months after the last extraction, good general health and total initial VSCs levels above the baseline level of 150ppb [18,19]. Patients with active caries, periodontitis, dental fluorosis / dysplasia of the teeth, syndromes or other abnormalities of the craniofacial complex, mental problems, subjects smoking or using other tobacco products [8], taking antibiotics during the last two months, use of chlorhexidine or another mouthwash in the last 3 weeks, allergy to mastic and participating in other trials were excluded [19]. 30 consecutive patients who visited the orthodontic treatment for their scheduled appointment and met the inclusion criteria were recruited at the Department of

Orthodontics, Dental School of Athens, NKUA. The principal investigator was calibrated for the measurement of the periodontal indices at the Postgraduate Clinic of the Department of Periodontology, NKUA. All measurements were conducted by the same investigator at the Postgraduate Clinic of the Department of Orthodontics, NKUA.

Interventions

All 30 patients were randomly assigned to either the mastic mouthwash group A (Art of Nature Mastiha Mouthwash, Mastihashop, Greece) (n = 15) or the placebo mouthwash group B (from the same manufacturer) (n = 15) (Table I). All patients were asked to use the mouthwash twice a day (10 ml of mouthwash / 2 times a day for 30 sec for 14 days, every morning and every night after brushing) and to maintain their usual oral hygiene routine. The measurements were done in the morning and at least three hours after brushing and without the use of the mouthwash by the participant on the day of the assessments. Participants were also asked to abstain from eating odiferous foods 24 hours prior to the measurements. Modified plaque (PI-M) [27] and gingival index (GI) [27], VSCs levels and subjective odor using the questionnaires were assessed at baseline (T0) and after use of mouthwash for two weeks (T1).

Outcomes

The main variables measured were VSCs levels {hydrogen sulfide (H_2S), methyl-mercaptan (CH_3SH) and dimethyl sulfide [$(CH_3)_2S$]} with the OralChroma^{TM} device (NOVATRONIC Deutschland GmbH, Kölner Straße 102, D-51429 Bergisch Gladbach)

(Figure 1), subjective malodor levels and oral hygiene through the modified plaque index (PI-M) and the gingival index (GI) [27].

The organoleptic evaluation was not performed due to the pandemic of the SARS-Covid 19 virus. The odor assessment was subjectively performed by the patient and scoring was based on a scale similar to the one used in organoleptic method (printed questionnaires) (Table II).

The objective assessment of the T0-T1 VSCs levels was done with the OralChroma^{TM}. This chromatograph measured the concentrations of the oral gases H_2S, CH_3SH and $(CH_3)_2S$. The sample was collected using disposable syringes (1ml plastic syringes), whose tip was inserted into the patient's oral cavity. The patients were asked to breathe with their mouth closed for 30 seconds. The samples were collected by pulling the plunger. Then the syringe's hub was inserted into the measuring device and 0.5ml of air was injected into the device.

Banded molars were excluded from the PI-M measurements since plaque detection was difficult at corresponding gingival margins. Silness & Löe plaque index (1964) [28] does not consider how the plaque is accumulated in orthodontic patients. To overcome this problem, a modification of the indexes was used in which the teeth were divided into mesial, distal, and incisal areas relative to the bracket, and plaque was graded in each area using values from 0 to 3 [29]. The values were summed to obtain an overall score, which ranged from 0 to 9 for each tooth. The sum of all teeth was divided by the surfaces measured and a mean score for each patient was obtained (Table III). This modified index has been suggested for patients with fixed orthodontic appliances because it evaluates the effect of these appliances on the plaque distribution and has a much higher categorical distinctive ability.

The measurements or the GI were done on the three areas of the buccal surface of each tooth (mesial, cervical and distal), as described above. The banded molars were also evaluated, and a mean score was calculated, as in the PI-M (Table IV).

There were no outcome changes after trial commencement.

Sample size calculation

The sample size was calculated based on a recent study which used as a mean expected difference of VSCs levels the value 50ppb, standard deviation 40, α-level at 5% and power 90%. According to the assumptions the required sample size was14 patients per treatment arm, rounded up to a total of 30 patients (15 per group) [30].

Randomization (sequence generation, type, allocation concealment, implementation)

All patients were allocated at a 1:1 ratio between group A (mastic group) and group B (placebo group), for each sex separately using stratified randomization. Two random sequences of 15 letters (A or B) were obtained from www.random.org (List Randomizer service), one for males and one for females. Those letters were written on paper and then sealed in opaque envelopes, sequentially numbered from M1 to M15 for males and from F1 to F15 for females respectively. All envelopes were sealed, numbered and stored in a drawer by a person not involved in the study. Every patient enrolled in the study received an envelope in a numerical order and their name was written on the envelope. Informed consent was obtained from parents / legal guardians and written consent upon information and prior to the randomization or application of any procedure was obtained from the patients.

Blinding

All participants received mouthwashes whose packaging was identical and both participants and investigators were blinded to the distribution. A person not involved in the study was in charge of opening each envelope and providing the appropriate mouthwash to each participant.

Statistical analysis

Inter and intra observer error was evaluated for the VSCs measurements performing double measurements of some enrollees by another investigator and the principal investigator respectively. All data were statistically analyzed, using median regression analysis for all the variables except from the subjective odor where ordinal logistic regression analysis was used. Predictors were the treatment and the baseline value of the outcome. All analyses were conducted using Stata 17 (StataCorp, TX, USA).

Results

Participant flow

58 patients were assessed for eligibility until 30 patients who fulfilled all eligibility criteria were recruited. Patient recruitment commenced in May 2022 and ended in January 2023 (Figure 2).

Baseline data

Baseline data are depicted on Tables V and VI.

Number analyzed for each outcome

All 30 patients were analyzed for all outcomes.

Outcomes and estimation

The descriptive characteristics revealed a not-normally distributed sample. Intraclass correlation coefficients for inter- and intra-observer reliability indicated good (0.88) to excellent (0.97) results respectively. The differences between the groups were the following (median values): for the mastic group (group A) the total VSCs levels dropped from 245.00ppb to 152.00ppb, and more specifically H_2S dropped from 221.00ppb to 125.00ppb, CH_3SH dropped from 31.00ppb to 17.00ppb and $(CH_3)_2S$ raised from 3.00 to 7.00ppb. For the placebo group (Group B) the total VSCs levels dropped from 264.00ppb to 249.00, and more specifically H_2S dropped from

230.00ppb to 220.00ppb, CH_3SH remained the same 17.00ppb and $(CH_3)_2S$ dropped from 13.00 to 0.00ppb. The effect of treatment was statistically significant only for H_2S (Table VII). No differences were found between the subjective scores. The PI-M score (median) for group A dropped from 1.27 to 1.04 whereas for group B it dropped from 1.03 to 0.96. The GI score (median) for group A dropped from 1.28 to 1.15 whereas for group B it increased from 1.07 to 1.11. None of the changes differ statistically between treatment arms (Table VI).

Ancillary analyses

No ancillary analyses were performed.

Harms

No harms were observed from the use of the mouthwashes.

Discussion

Main findings in the context of the existing evidence and interpretation

The present study demonstrated a reduction of the oral H_2S levels of orthodontic patients after 2 weeks of mastic mouthwash use. According to the literature, the main VSC contributing to oral malodor is believed to be hydrogen sulfide (H_2S) and a recent study with OralChroma^{TM}, assessed only the level of this component [31]. Nevertheless, methyl mercaptan (CH_3SH) and dimethyl sulfide $(CH_3)_2S$ may also play a secondary role [32-33]. The levels of these two VSCs changed in the present trial in both groups, however these differences did not reach statistical significance. A recent randomized controlled trial also evaluated the VSCs levels and halitosis after application of a tablet containing herbal formulation, including mastic. VSCs levels were significantly reduced in that study, however its configuration (halimetry) did not allow distinction between each VCS level [34].

Halitosis has been mainly attributed to bacterial activity [10-11]. Mastic extract's inhibition of both periodontal and cariogenic pathogens has been demonstrated in the literature [24-26]. In a randomized controlled study, which investigated the effect of a mastic mouthwash on dental plaque bacteria and subgingival microorganisms, the mean aerobic plaque bacteria count was significantly reduced for the mastic mouthwash group compared to the placebo group (p=0.001) [25].

Thus, mastic has been proposed as a promising alternative to the most widely used chlorhexidine (CHX) or hydrogen peroxide (H_2O_2) as an oral antibacterial agent [26]. Mastic extract has been reported to induce significantly increased inhibition of oral

pathogens when compared to H_2O_2, and comparable although lower inhibition when compared to CHX [26]. On the other hand, according to the same study, mastic showed beneficial effects on cell viability, as viability values of tested cells were significantly lower for the cells treated with CHX and H_2O_2 compared with mastic extract treated cells, and therefore mastic may constitute a useful antibacterial agent with minimal side effects [26].

The interventions in the present study did not change the periodontal parameters of the groups in a statistically significant way. Other studies comparing mouthwashes based on herbal extracts have also failed to report any significant alterations in periodontal indices [34-36]. Moreover, a recent systematic review and meta-analysis on the efficacy of propolis-based mouthwashes on dental plaque and inflammation failed to show any concrete results on the superiority of these mouthwashes on reducing periodontal indices [36]. High quality recent evidence indicated that the use of chlorhexidine mouthwashes may decrease the GI in individuals with mild gingival inflammation, however that reduction was not considered to be clinically significant [37]. According to the same study, a larger reduction in dental plaque is expected with chlorhexidine mouthwashes when used as an adjunct to mechanical oral hygiene [37]. In our study the patients were given no specific instructions on brushing. A systematic review and meta-analysis on the efficacy of curcumin versus chlorhexidine mouthwashes reported comparable reduction of dental plaque and gingival inflammation [35].

Limitations

The objective organoleptic assessment by a calibrated examiner is rather important, since most individuals are poor judges of their own breath [38], but unfortunately this assessment was not performed due to the Covid-19 pandemic. The subjective evaluation by the patient did not reveal any statistically significant differences between the groups, however, the age group may have influenced this measurement. Adolescents of the present sample may have underestimated their own oral malodor, since the need for social acceptance in this age group constitutes a priority [39].

Generalizability

The presented results were obtained from measurements taken by a single investigator in a single center and a certain age group, hence, affecting generalizability. The study population were adolescents and results may differ on adult population due to cooperation issues.

Conclusions

1. The evaluated mastic mouthwash may control halitosis in adolescents undergoing orthodontic treatment with fixed appliances after 2 weeks of usage. However only the H_2S {and not CH_3SH and $(CH_3)_2S$} levels dropped during this time period.

2. The mastic mouthwash did not improve oral hygiene indices.

3. Subjective questionnaires on oral malodor may not be a useful tool for measuring halitosis levels in adolescent patients.

Registration

The trial was registered at ClinicalTrials.gov. Identifier: NCT05647369

Protocol

The protocol of the study has been compiled according to the SPIRIT Statement Protocol instructions and has been approved by the Ethics Committee of the School of Dentistry, National and Kapodistrian University of Athens (NKUA), Greece.

Protocol number: 461/12.03.2021

Conflict of interest

None to declare.

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Tables

Table I. Main ingredients of the evaluated mouthwashes (w/w %).

		Mastic water	Mastic oil	Mastic flavor	Deionized water	Sodium fluoride	Alcohol	Mentho l
A.	Mastic Mouthwash	20	0,05	0,15	44,5	0,055	5	0,05
B.	Placebo	-	-	-	64,7	0,055	5	0,05

Table II. Subjective scale of halitosis.

0	Absence of halitosis
1	Almost noticeable halitosis
2	Slight, but clearly noticeable halitosis
3	Moderate halitosis
4	Severe halitosis
5	Extremely strong halitosis

Table III. Plaque index[27].

0	No plaque.
1	Thin plaque attached to the gingival margin and adjacent areas of the tooth. Plaque is only visible after applying a revealing solution or using a probe on the tooth surface.
2	Moderate accumulation of soft plaque deposits in the gingival sulcus or plaque on the gingival margin and adjacent areas of the tooth visible to the naked eye.
3	Abundant soft plaque deposits in the gingival sulcus or plaque on the gingival margin and adjacent areas of the tooth.

Table IV. Gingival index[27].

0	Normal gums.
1	Mild inflammation, slight change in color and distinct change in texture, no bleeding upon probing.
2	Moderate inflammation, moderate redness and swelling, bleeding upon probing.
3	Severe inflammation, visible swelling, ulceration, bleeding upon probing and/or spontaneously.

Table V. VSCs levels for hydrogen sulfide (H_2S), methyl-mercaptan (CH_3SH) and dimethyl sulfide [$(CH_3)_2S$] at T0 and T1 for the mastic group (group A) and the placebo group (group B) in ppb (median values, interquartile range-IQR).

	A: Mastic		**B: Placebo**	
	median	iqr	median	iqr
H2S_T0	221.00	71.00	230.00	155.00
H2S_T1	125.00	80.00	220.00	109.00
CH3SH_T0	31.00	18.00	17.00	21.00
CH3SH_T1	17.00	16.00	17.00	17.00
(CH3)2S_T0	3.00	32.00	13.00	26.00
(CH3)2S_T1	7.00	29.00	0.00	20.00
SUM_T0	245.00	62.00	264.00	191.00
SUM_T1	152.00	78.00	249.00	112.00

Table VI. Subjective and periodontal indices scores at T0 and T1 for the mastic group (group A) and the placebo group (group B) (median values, interquartile range-IQR).

	A: Mastic		**B: Placebo**	
	median	iqr	median	iqr
Sub_T0	1	2	1	1
Sub_T1	1.00	1.00	1.00	0.00
PImean_T0	1.27	0.61	1.03	0.42
PImean_T1	1.04	0.38	0.96	0.38
GImean_T0	1.28	0.61	1.07	0.31
GImean_T1	1.15	0.26	1.11	0.30

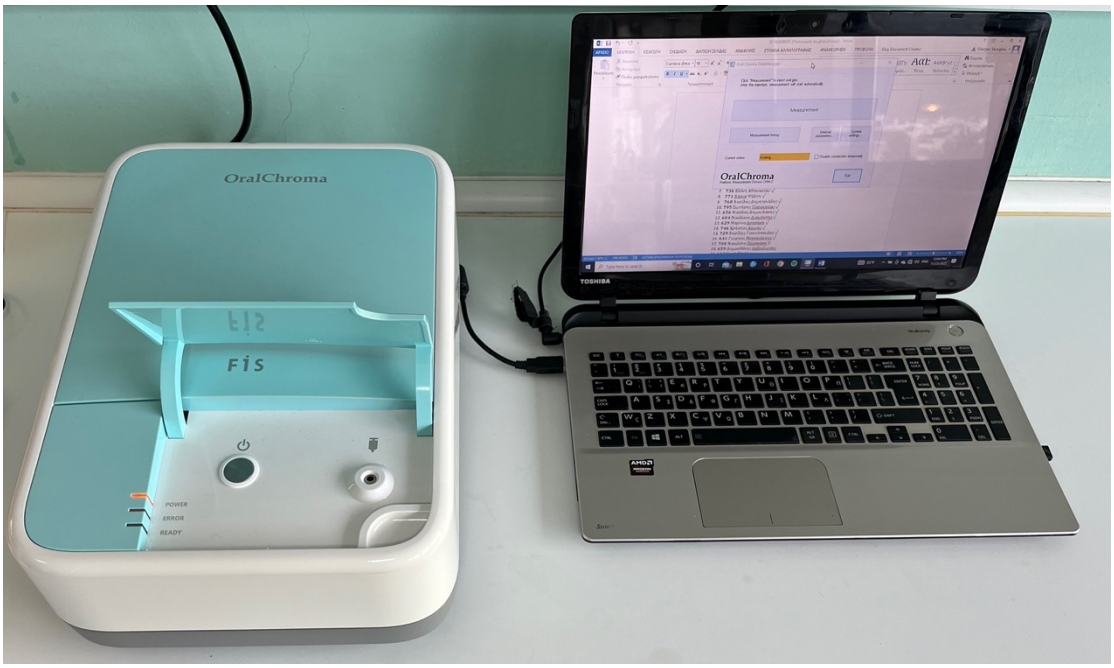
Table VII. Statistical analysis results.

		Coef	95% confidence interval	p-value
	TRX A reference			
H2S	TRX B	72.38	8.48, 136.28	0.03
	Baseline	0.61	0.26, 0.96	0.001
$(CH_3)_2S$	TRX B	-0.52	-7.10, 6.06	0.87
	Baseline	0.83	0.70, 0.95	<0.001
CH_3SH	TRX B	1.94	-19.15, 15.26	0.819
	Baseline	0.059	-0.33, 0.45	0.762
Sum	TRX B	60.17	-13.77, 134.12	0.11
	Baseline	0.71	0.37, 1.06	<0.001

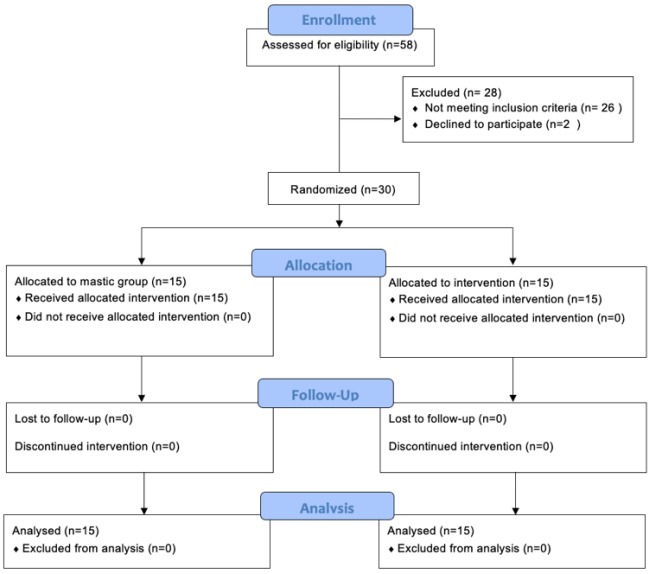
		Odds Ratio	95% confidence interval	p-value
Subjective evaluation	TRX B	0.49	0.09, 2.66	0.41
	Baseline	11.11	2.97, 41.56	<0.001

Figures

1. The OralChroma^{TM} device at the Orthodontic Department, Dental School of Athens, NKUA



2. Participant flow diagram



Appendix

Randomization via Random.org

males There were 20 items in your list. Here they are in random order:

A
A
A
B
B
B
B
A
B
A
B
B
A
B
A
A
A
B
B
A

IP: 195.134.98.196
Timestamp: 2021-11-24 08:55:56 UTC

females There were 20 items in your list. Here they are in random order:

A

A

B

B

B

B

A

A

B

B

A

B

A

A

A

B

B

A

B

A

IP: 195.134.98.196
Timestamp: 2021-11-24 09:22:55 UTC

Printed questionnaire and indexes assessment form

1. Κακοσμία/ Επίπεδα πτητικών ενώσεων θείου (VSCs)

	H2S	CH3SH	CH3)2S	σύνολο
T0				
T1				

2. Αριθμητική, Αναλογική και Λειτουργική αξιολόγηση της κακοσμίας

	0 απουσία κακοσμίας	1 Σχεδόν αισθητή κακοσμία	2 Ελαφρώς αλλά σαφώς αισθητή κακοσμία	3 Μέτρια κακοσμία	4 Έντονη κακοσμία	5 Εξαιρετικά έντονη κακοσμία
T0						
T1						

3. Τροποποιημένος δείκτης πλάκας Silness &Löe (PI-M)

0 Χωρίς πλάκα.
1 Λεπτό υμένιο πλάκας προσκολλημένη στην ουλική παρυφή και στις όμορες περιοχές του δοντιού. Η πλάκα είναι εμφανής μόνο μετά την εφαρμογή αποκαλυπτικού διαλύματος ή τη χρήση ανιχνευτήρα στην επιφάνεια του δοντιού.
2 Μέτρια συσσώρευση μαλακών εναποθέσεων πλάκας στην ουλοδοντική σχισμή ή πλάκα στην ουλική παρυφή και στις όμορες περιοχές του δοντιού ορατή με γυμνό μάτι.
3 Άφθονες μαλακές εναποθέσεις πλάκας εντός της ουλοδοντικής σχισμής ή στην ουλική παρυφή και στις όμορες περιοχές του δοντιού.

Η συνολική βαθμολογία κάθε δοντιού θα προκύπτει από το άθροισμα όλων των επιφανειών διαιρούμενο με τον συνολικό αριθμό των επιφανειών που μετρήθηκαν. Παρειακά. ΕΓΓΥΣ-ΚΟΠΤΙΚΑ-ΑΠΩ

	25	24	23	22	21	11	12	13	14	15	ΣΥΝΟΛΟ
T0											
T1											
	35	**34**	**33**	**32**	**31**	**41**	**42**	**43**	**44**	**45**	**ΣΥΝΟΛΟ**
T0											
T1											

4. Δείκτης Φλεγμονής των ούλων (GI)

0 Φυσιολογικά ούλα.
1 Ήπια φλεγμονή, ελαφρά μεταβολή στο χρώμα και διακριτή μεταβολή στην υφή, καμία αιμορραγία κατά την εξέταση.
2 Μέτρια φλεγμονή, μέτρια ερυθρότητα και οίδημα, αιμορραγία κατά την εξέταση.
3 Σοβαρή φλεγμονή, εμφανής ερυθρότητα και οίδημα/διόγκωση, εξέλκωση, αιμορραγία κατά την εξέταση και/ή αυθόρμητα.

ΠΑΡΕΙΑΚΑ. ΕΓΓΥΣ-ΑΥΧΕΝΙΚΑ-ΑΠΩ

	26	25	24	23	22	21	11	12	13	14	15	16	ΣΥΝΟΛΟ
T0													
T1													
	36	**35**	**34**	**33**	**32**	**21**	**41**	**42**	**43**	**44**	**45**	**46**	**ΣΥΝΟΛΟ**
T0													
T1													

Ages

Subject	Age, Months	Age	
F1	16, 0	16	
F2	13, 10	13,83	
F3	17, 3	17,25	
F4	14, 4	14,33	
F5	14, 6	14,5	
F6	15, 4	15,33	
F7	13, 6	13,5	
F8	13, 1	13,08	
F9	15, 2	15,16	
F10	15, 0	15,0	
F11	14, 8	14,66	
F12	17, 4	17,33	
F13	13, 6	13,5	
F14	16, 10	16,83	
F15	15, 4	15,33	
M1	12, 5	12,42	
M2	16, 3	16,25	
M3	15, 9	15,75	
M4	15, 11	15,92	
M5	17, 10	17,83	
M6	17, 10	17,23	
M7	14, 10	14,83	
M8	14, 6	14,5	
M9	12, 8	12,66	
M10	13, 5	13,42	
M11	13, 3	13,25	
M12	13, 7	13,58	
M13	13, 7	13,58	
M14	16, 8	16,66	
M15	16, 1	16,08	

#	a or b	T0-H2S	T0-CH3SH	T0-CH32S	T0-SINOLO	T0-YPOKEIM	T0- PI-M SU	T0- MEAN PI	T0-GI SUM	T0-MEAN GI	T1-H2S	T2-CH3SH	T2-CH32S	T1-SINOLO	TI-YPOKEIME	T1-PI-M SUN	T1-MEAN PI-	T1-GI SUM	T1-MEAN GI
F1	A	169	62	51	282	1	76	1,267	92	1,277	103	12	37	152	1	57	0,95	85	1,18
F2	A	85	37	32	154	3	67	1,116	101	1,402	63	14	9	86	1	55	0,916	89	1,236
F3	B	258	6	0	264	1	45	0,833	66	1,031	237	12	0	249	1	46	0,852	68	1,062
F4	B	187	17	0	204	1	64	1,067	86	1,194	213	12	0	225	1	63	1,05	85	1,18
F5	B	241	24	16	281	2	42	0,7	55	0,763	220	4	6	230	1	39	0,65	62	0,861
F6	B	247	35	17	299	1	55	1,018	101	1,53	223	27	21	271	1	52	0,963	93	1,409
F7	A	161	8	0	169	2	108	2	87	1,318	59	18	29	106	2	77	1,426	77	1,166
F8	A	240	31	6	277	1	49	1,02	46	1,766	213	48	11	272	2	47	0,979	52	0,866
F9	B	437	115	37	589	1	67	1,396	96	1,6	339	102	20	461	1	64	1,333	96	1,6
F10	B	138	7	13	158	0	44	0,733	70	0,972	148	4	0	152	0	46	0,767	70	0,972
F11	A	185	32	28	245	1	49	0,816	62	0,861	105	13	17	135	1	42	0,7	59	0,819
F12	B	230	21	0	251	1	48	0,8	48	0,66	257	17	0	274	1	48	0,8	51	0,708
F13	A	307	32	6	345	3	83	1,383	88	1,222	125	18	7	150	2	66	1,1	90	1,25
F14	A	221	21	3	245	1	62	1,148	75	1,136	118	28	0	146	1	56	1,037	71	1,075
F15	A	207	22	3	232	1	58	1,074	75	1,136	183	27	3	213	1	52	0,962	74	1,121
M1	A	121	33	66	220	3	93	1,55	137	1,903	65	0	72	137	3	78	1,3	139	1,93
M2	A	175	6	0	181	3	105	1,75	102	1,417	180	17	0	197	2	65	1,083	80	1,111
M3	A	353	37	3	393	3	78	1,625	142	2,367	137	16	7	160	2	62	1,292	117	1,95
M4	B	210	13	0	223	2	73	1,217	82	1,139	186	0	0	186	1	66	1,1	84	1,17
M5	B	129	14	42	185	3	38	0,704	48	0,727	181	15	81	277	2	37	0,685	53	0,803
M6	B	390	28	26	444	3	63	1,05	62	0,886	384	69	18	471	3	81	1,35	81	1,157
M7	B	112	17	46	175	2	48	0,8	81	1,125	103	24	38	165	2	52	0,87	86	1,194
M8	A	380	15	120	515	1	113	1,883	126	1,75	355	8	106	469	1	104	1,733	114	1,583
M9	B	298	65	13	376	1	62	1,033	77	1,069	325	18	7	350	1	61	1,017	80	1,111
M10	A	227	31	0	258	0	43	0,717	56	0,778	115	12	7	134	0	45	0,75	62	0,861
M11	B	442	17	0	459	1	77	1,283	84	1,167	237	20	0	257	1	55	0,917	80	1,111
M12	B	229	37	0	266	2	63	1,105	62	0,898	75	62	0	137	0	71	1,246	61	0,884
M13	A	232	3	0	235	2	46	0,767	76	1,055	169	36	0	205	2	43	0,717	71	0,986
M14	B	143	16	0	159	1	84	1,4	82	1,389	127	10	0	137	1	71	1,183	80	1,111
M15	A	222	15	0	237	1	84	1,4	92	1,278	213	65	0	278	1	76	1,267	83	1,153

#		H2S OBSERVER1	CH3SH OBSERVER1	CH32S OBSERVER 1	SINOLO OBSERVER 1	H2S OBSERVER2	CH3SH OBSERVER2	CH32S OBSERVER 2	SINOLO OBSERVER 2
1		126	19	0	145	130	12	0	142
2		251	17	12	280	263	17	11	291
3		232	42	6	280	213	48	11	272
4		229	12	81	312	181	15	133	329
5		178	15	0	193	165	13	0	178
					INTRAOBSERVER				
		H2S 1i	CH3SH 1i	CH32S 1i	SINOLO 1i	H2S 2i	CH3SH 2i	CH32S 2i	SINOLO 2i
1		151	12	0	163	151	21	0	172
2		380	15	120	515	347	12	155	514
3		237	20	0	257	250	21	0	271
4		229	37	0	266	217	41	0	258
5		217	22	16	255	210	24	15	249

```
-------------------------------------------------------------------------------------------------
------
id
(unlabeled)
-------------------------------------------------------------------------------------------------
------

                  Type: String (str3)

         Unique values: 30                         Missing "": 0/30

               Examples: "F14"
                         "F6"
                         "M11"
                         "M3"

-------------------------------------------------------------------------------------------------
------
h2s_t0
H2S_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [85,442]                      Units: 1
         Unique values: 30                         Missing .: 0/30

                  Mean: 232.533
             Std. dev.: 93.2571

           Percentiles:     10%       25%       50%       75%       90%
                            125       169     224.5       258       385

-------------------------------------------------------------------------------------------------
------
ch3sh_t0
CH3SH_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [3,115]                       Units: 1
         Unique values: 21                         Missing .: 0/30

                  Mean: 27.2333
             Std. dev.: 22.2008

           Percentiles:     10%       25%       50%       75%       90%
                            6.5        15      21.5        33      49.5

-------------------------------------------------------------------------------------------------
------
ch32s_t0
CH32S_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [0,120]                       Units: 1
         Unique values: 15                         Missing .: 0/30

                  Mean:   17.6
             Std. dev.: 26.768

           Percentiles:    10%       25%       50%       75%       90%
                             0         0       4.5        28      48.5

-------------------------------------------------------------------------------------------------
------
```

```
sinolo_t0
SINOLO_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [154,589]                     Units: 1
         Unique values: 29                         Missing .: 0/30

                  Mean: 277.367
             Std. dev.: 109.328

           Percentiles:     10%       25%       50%       75%       90%
                            164       204       248       299     451.5

-------------------------------------------------------------------------------------------------
------
subjective_t0
(unlabeled)
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (byte)

                 Range: [0,3]                         Units: 1
         Unique values: 4                          Missing .: 0/30

            Tabulation: Freq.  Value
                          2  0
                         15  1
                          6  2
                          7  3

-------------------------------------------------------------------------------------------------
------
pi_m_sum_t0
PI_M_SUM_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [38,113]                      Units: 1
         Unique values: 24                         Missing .: 0/30

                  Mean: 66.2333
             Std. dev.: 20.5555

           Percentiles:     10%       25%       50%       75%       90%
                           43.5        48        63        78        99

-------------------------------------------------------------------------------------------------
------
mean_pi_t0
MEAN_PI_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (float)

                 Range: [.7,2]                        Units: .001
         Unique values: 28                         Missing .: 0/30

                  Mean: 1.15517
             Std. dev.: .358189

           Percentiles:     10%       25%       50%       75%       90%
                           .725      .816    1.0895     1.396    1.6875

-------------------------------------------------------------------------------------------------
------
gi_sum_t0
GI_SUM_t0
```

```
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [46,142]                      Units: 1
         Unique values: 23                         Missing .: 0/30

                  Mean:    81.9
             Std. dev.: 24.1637

           Percentiles:     10%       25%       50%       75%       90%
                           51.5        62      81.5        92       114

-------------------------------------------------------------------------------------------------
------
mean_gi_t0
MEAN_GI_t0
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (float)

                 Range: [.66,2.367]                   Units: .001
         Unique values: 29                         Missing .: 0/30

                  Mean:  1.2272
             Std. dev.: .380661

           Percentiles:     10%       25%       50%       75%       90%
                          .7705      .972     1.153     1.402     1.758

-------------------------------------------------------------------------------------------------
------
h2s_t1
H2S_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [59,384]                      Units: 1
         Unique values: 26                         Missing .: 0/30

                  Mean: 181.933
             Std. dev.: 88.0015

           Percentiles:     10%       25%       50%       75%       90%
                             70       115     180.5       223       332

-------------------------------------------------------------------------------------------------
------
ch3sh_t1
CH3SH_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [0,102]                       Units: 1
         Unique values: 21                         Missing .: 0/30

                  Mean: 24.2667
             Std. dev.:  23.159

           Percentiles:     10%       25%       50%       75%       90%
                             4        12        17        27      63.5

-------------------------------------------------------------------------------------------------
------
ch32s_t1
CH32S_t1
-------------------------------------------------------------------------------------------------
------
```

```
                  Type: Numeric (int)

                 Range: [0,106]                       Units: 1
          Unique values: 16                           Missing .: 0/30

                  Mean: 16.5333
             Std. dev.:  26.478

            Percentiles:     10%       25%       50%       75%       90%
                              0         0         7        20        55

-------------------------------------------------------------------------------------------------
------
sinolo_t1
SINOLO_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [86,471]                      Units: 1
          Unique values: 27                           Missing .: 0/30

                  Mean: 222.733
             Std. dev.:  103.62

            Percentiles:     10%       25%       50%       75%       90%
                           134.5       146       201       272     405.5

-------------------------------------------------------------------------------------------------
------
subjective_t1
(unlabeled)
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (byte)

                 Range: [0,3]                         Units: 1
          Unique values: 4                            Missing .: 0/30

             Tabulation: Freq.  Value
                           3  0
                          17  1
                           8  2
                           2  3

-------------------------------------------------------------------------------------------------
------
pi_m_sum_t1
PI_M_SUM_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                 Range: [37,104]                      Units: 1
          Unique values: 24                           Missing .: 0/30

                  Mean: 59.2333
             Std. dev.: 14.8293

            Percentiles:     10%       25%       50%       75%       90%
                           42.5        47      56.5        66      77.5

-------------------------------------------------------------------------------------------------
------
mean_pi_t1
MEAN_PI_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (float)
```

```
                Range: [.65,1.733]                  Units: .001
         Unique values: 29                       Missing .: 0/30

                 Mean: 1.03317
            Std. dev.: .255819

           Percentiles:     10%       25%       50%       75%       90%
                          .7085      .852      .998     1.246    1.3415

-------------------------------------------------------------------------------------------------
------
gi_sum_t1
GI_SUM_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (int)

                Range: [51,139]                     Units: 1
         Unique values: 24                       Missing .: 0/30

                 Mean: 79.7667
            Std. dev.: 19.4558

           Percentiles:     10%       25%       50%       75%       90%
                             56        68        80        86       105

-------------------------------------------------------------------------------------------------
------
mean_gi_t1
MEAN_GI_t1
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (float)

                Range: [.708,1.95]                  Units: .001
         Unique values: 25                       Missing .: 0/30

                 Mean:   1.154
            Std. dev.: .296502

           Percentiles:     10%       25%       50%       75%       90%
                             .84      .972     1.116     1.194    1.5915

-------------------------------------------------------------------------------------------------
------
trx
(unlabeled)
-------------------------------------------------------------------------------------------------
------

                  Type: Numeric (long)
                 Label: treat

                Range: [1,2]                        Units: 1
         Unique values: 2                        Missing .: 0/30

            Tabulation: Freq.   Numeric  Label
                           15         1  A
                           15         2  B
```

Tabulated data per variable and treatment group

```
tabstat h2s_t* ch3sh_t* ch32s_t* sinolo_t* subjective_t* pi_m_sum_t* mean_pi_t*
gi_sum_t* mean_gi_t*,by(trx) stat(mean sd p50 iqr) nototal format( %4.2f)
```

trx		h2s_t0	h2s_t1	ch3sh_t0	ch3sh_t1	ch32s_t0	ch32s_t1	sinolo~0	sinolo~1
A	mean	219.00	146.87	25.67	22.13	21.20	20.33	265.87	189.33
	sd	79.72	76.77	15.22	16.69	34.35	30.56	92.56	94.80
	median	221.00	125.00	31.00	17.00	3.00	7.00	245.00	152.00
	iqr	71.00	80.00	18.00	16.00	32.00	29.00	62.00	78.00
B		246.07	217.00	28.80	26.40	14.00	12.73	288.87	256.13
		106.15	86.68	28.00	28.68	16.62	22.08	126.13	104.23
		230.00	220.00	17.00	17.00	13.00	0.00	264.00	249.00
		155.00	109.00	21.00	17.00	26.00	20.00	191.00	112.00

trx	subjec~1	pi_m_s~0	pi_m_s~1	mean_p~0	mean_p~1	gi_sum~0	gi_sum~1	mean_g~0	mean_g~1
A	1.47	74.27	61.67	1.30	1.08	90.47	84.20	1.38	1.22
	0.74	23.37	16.80	0.40	0.28	28.05	23.47	0.42	0.35
	1.00	76.00	57.00	1.27	1.04	88.00	80.00	1.28	1.15
	1.00	44.00	29.00	0.61	0.38	27.00	19.00	0.61	0.26
B	1.13	58.20	56.80	1.01	0.99	73.33	75.33	1.08	1.09
	0.74	13.82	12.68	0.24	0.22	16.29	13.82	0.28	0.23
	1.00	62.00	55.00	1.03	0.96	77.00	80.00	1.07	1.11
	0.00	22.00	20.00	0.42	0.38	22.00	23.00	0.31	0.30

```
tab subjective_t0 trx,col chi2

subjective |          trx
       _t0 |         A          B |     Total
-----------+----------------------+----------
         0 |         1          1 |         2
           |      6.67       6.67 |      6.67
-----------+----------------------+----------
         1 |         7          8 |        15
           |     46.67      53.33 |     50.00
-----------+----------------------+----------
         2 |         2          4 |         6
           |     13.33      26.67 |     20.00
-----------+----------------------+----------
         3 |         5          2 |         7
           |     33.33      13.33 |     23.33
-----------+----------------------+----------
     Total |        15         15 |        30
           |    100.00     100.00 |    100.00

          Pearson chi2(3) =   2.0190   Pr = 0.568
```

median regression using as predictor the treatment and adjusting for the baseline value of the variable.

```
qreg h2s_t1 i.trx h2s_t0,base

------------------------------------------------------------------------------
      h2s_t1 | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         trx |
          A  |          0  (base)
          B  |   72.37895   31.14186     2.32   0.028     8.481133    136.2768
             |
      h2s_t0 |   .6105263   .1698222     3.60   0.001     .2620799    .9589727
       _cons |  -.1789474   43.09894    -0.00   0.997    -88.61067    88.25278
------------------------------------------------------------------------------

. qreg ch32s_t1 i.trx ch32s_t0 ,base

Median regression                               Number of obs =         30
  Raw sum of deviations      232 (about 7)
  Min sum of deviations 96.56522                Pseudo R2     =     0.5838

------------------------------------------------------------------------------
    ch32s_t1 | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         trx |
          A  |          0  (base)
          B  |  -.5217391   3.209474    -0.16   0.872    -7.107036    6.063558
             |
    ch32s_t0 |    .826087   .0609748    13.55   0.000     .7009771    .9511968
       _cons |   .5217391   2.593256     0.20   0.842    -4.799182     5.84266
------------------------------------------------------------------------------

qreg ch3sh_t1 i.trx ch3sh_t0 ,base

------------------------------------------------------------------------------
    ch3sh_t1 | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         trx |
          A  |          0  (base)
          B  |  -1.941176   8.387588    -0.23   0.819    -19.15109    15.26873
             |
    ch3sh_t0 |   .0588235   .1921323     0.31   0.762    -.3353994    .4530465
       _cons |   16.11765   7.701511     2.09   0.046     .3154513    31.91984
------------------------------------------------------------------------------

qreg sinolo_t1 i.trx sinolo_t0,base
------------------------------------------------------------------------------
   sinolo_t1 | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         trx |
          A  |          0  (base)
          B  |   60.17391   36.03738     1.67   0.107    -13.76868    134.1165
             |
   sinolo_t0 |   .7149758   .1676313     4.27   0.000     .3710248    1.058927
       _cons |  -20.29469    51.2658    -0.40   0.695    -125.4834    84.89406
------------------------------------------------------------------------------
```

Ordinal logistic regression

```
. ologit subjective_t1 i.trx subjective_t0,base

------------------------------------------------------------------------------
subjective_t1 | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
          trx |
           A  |          0  (base)
           B  |  -.7085721   .8600137    -0.82   0.410    -2.394168    .9770238
              |
subjective_t0 |   2.407784   .6731534     3.58   0.000     1.088427     3.72714
--------------+---------------------------------------------------------------
        /cut1 |  -.0613279   1.042323                     -2.104242    1.981587
        /cut2 |   4.551288    1.36833                      1.869411    7.233166
        /cut3 |   7.996936   2.007927                      4.061472     11.9324
------------------------------------------------------------------------------

.
```

Intraclass correlations

```
Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id                Number of targets =         5
                                  Number of raters  =         2

------------------------------------------------------------------
                   h2s |        ICC       [95% conf. interval]
-----------------------+------------------------------------------
            Individual |   .8839996       .3746817    .9869359
               Average |   .9384286       .5451178     .993425
------------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 16.24               Prob > F = 0.005

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.



Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id                Number of targets =         5
                                  Number of raters  =         2

------------------------------------------------------------------
                 ch3sh |        ICC       [95% conf. interval]
-----------------------+------------------------------------------
            Individual |   .9475305       .6679992    .9942625
               Average |   .9730584       .8009587     .997123
------------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 37.12               Prob > F = 0.001

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.
```

```
Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id               Number of targets =         5
                                 Number of raters  =         2

------------------------------------------------------------------
                ch32s |        ICC       [95% conf. interval]
----------------------+-------------------------------------------
           Individual |   .8783111       .3525996    .9862584
              Average |   .9352136       .5213658    .9930817
------------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 15.44               Prob > F = 0.005

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.


Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id               Number of targets =         5
                                 Number of raters  =         2

------------------------------------------------------------------
                sinolo |        ICC       [95% conf. interval]
----------------------+-------------------------------------------
           Individual |   .9872699       .9096257    .9986328
              Average |   .9935942       .9526743    .9993159
------------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 156.11              Prob > F = 0.000

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.

.   foreach myvar of varlist h2s ch3sh ch32s sinolo {
  2.  icc `myvar' id if var7=="intra"
  3.  }



Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id               Number of targets =         5
                                 Number of raters  =         2

------------------------------------------------------------------
                  h2s |        ICC       [95% conf. interval]
----------------------+-------------------------------------------
           Individual |   .9762723       .8370517    .9974391
              Average |   .9879937        .911299    .9987179
------------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 83.29               Prob > F = 0.000

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.
```

```
Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id               Number of targets =         5
                                 Number of raters  =         2

------------------------------------------------------------
                ch3sh |        ICC       [95% conf. interval]
----------------------+-------------------------------------
           Individual |   .8931922       .4116312     .988023
              Average |   .9435832       .5831993    .9939754
------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 17.73               Prob > F = 0.004

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.



Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id               Number of targets =         5
                                 Number of raters  =         2

------------------------------------------------------------
                ch32s |        ICC       [95% conf. interval]
----------------------+-------------------------------------
           Individual |   .9666619        .777404    .9963861
              Average |   .9830484       .8747634    .9981898
------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 58.99               Prob > F = 0.000

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.



Intraclass correlations
One-way random-effects model
Absolute agreement

Random effects: id               Number of targets =         5
                                 Number of raters  =         2

------------------------------------------------------------
                sinolo |        ICC       [95% conf. interval]
----------------------+-------------------------------------
           Individual |   .9977884       .9837754    .9997636
              Average |    .998893       .9918213    .9998818
------------------------------------------------------------
F test that
  ICC=0.00: F(4.0, 5.0) = 903.31              Prob > F = 0.000

Note: ICCs estimate correlations between individual measurements
      and between average measurements made on the same target.
```