

Comparative Evaluation of Gingival Displacement Produced by Expasyl and Traxodent Retraction Systems: An In-Vivo Study

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ABSTRACT

Introduction:

Gingival displacement is of primary importance in the recording of the finish line of teeth in impression procedures in fixed prosthodontics. Several gingival retraction systems have been designed to attain adequate gingival displacement with minimal trauma to the tissues involved. However, there is limited evidence available regarding the clinical efficacy of the cordless gingival retraction materials that have been developed.

Aim:

To assess and compare the clinical efficacy of the gingival displacement systems, i.e., Expasyl gingival retraction paste and the Traxodent Hemodent paste retraction system.

Materials and Methods:

This in-vivo comparative study was conducted in the Department of Prosthodontics, Crown and Bridge, VSPM Dental College and Research Centre, Nagpur, Maharashtra, India, from January 2013 to June 2014. Thirty people with healthy gingival tissues who were between the ages of twenty and twenty-five participated in this in-vivo investigation. The control group (Group C) received the pre-displacement impressions. Following displacement, Group T received impressions using Traxodent while Group E received impressions using Expasyl. Gingival sulcus width was determined using 100x magnification and image analysis software after impressions were poured in dental stone, sectioned, and evaluated. Pre-displacement and post-displacement measurements were subtracted to determine the lateral gingival displacement. The statistical analysis employed a paired t-test and a one-way ANOVA with Bonferroni post-test for intergroup comparisons. The p value was taken as significant when less than 0.001.

Results:

For Expasyl and Traxodent, the average lateral gingival displacement values were 0.14 ± 0.05 mm and $0.12 \pm$

0.05 mm, respectively. When compared to the control group, both materials displayed significant values ($p < 0.001$). However, there was no significant value observed between both groups, $p = 0.0897$.

Conclusion:

Both Expasyl and Traxodent gingival retraction systems showed satisfactory values for gingival displacement, which is a must for impression making. There was no significant value observed between both materials.

Keywords: Aluminum Chloride; Dental Impression Technique; Fixed Prosthodontics; Gingiva; Sulcus Width

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Introduction

For the success and durability of fixed prosthodontic restorations, accurate reproduction of the finish line is of primary importance. Gingival displacement is used for temporarily deflecting the marginal gingival tissue away from tooth structure, allowing impression materials to flow into the gingival sulcus for accurate reproduction of prepared and unprepared tooth surfaces [1, 2].

Several techniques for gingival displacement have been advocated, including surgical, mechanical, and mechano-chemical approaches. Among them, the mechano-chemical technique of gingival displacement, where gingival retraction cords soaked with hemostatic agents are used, is the most commonly used technique [3]. This technique, although successful, has some disadvantages such as tissue trauma, bleeding, discomfort, and technique sensitivity [3,4].

TraxodentHemodent paste is a cordless gingival displacement material that contains aluminum chloride, which has the necessary properties to displace the gingiva and control hemorrhage. [5,6]

In the last few years, cordless gingival retraction systems have been developed as an alternative method for gingival displacement. These systems offer the prospect of effective sulcular dilation with minimal trauma to the gingival tissues, as well as improved patient comfort and reduced chair time. [7] Expasyl is a gingival retraction material in paste form that consists of aluminum chloride and kaolin, causing both mechanical and chemical gingival displacement. The aluminum chloride in the paste has an astringent and hemostatic effect, whereas the kaolin has the necessary pressure to dilate the gingival sulcus. [10]

Literature has stated that cordless gingival retraction systems have the ability to provide the requisite amount of gingival displacement for impression making with minimal trauma to the tissues [5,6]. However, not much clinical evidence is available on the relative effectiveness of the new

generation of paste materials for gingival retraction.

Although cordless gingival retraction systems are increasingly used in fixed prosthodontics, limited clinical evidence is available regarding the comparative efficacy of Expasyl and Traxodent. Therefore, this study was undertaken to compare their gingival displacement capabilities under standardized clinical conditions. The novelty of the study lies in the direct in-vivo comparison of these two paste-based retraction systems using microscopic evaluation of lateral gingival displacement.

Aim

The present study aimed to evaluate and compare the clinical efficacy of two cordless gingival retraction systems—**Expasyl gingival retraction paste** and the **TraxodentHemodent Paste Retraction System**—by assessing the amount of lateral gingival displacement produced under standardized clinical conditions.

Objectives

The objectives of the study were to: (1) evaluate the gingival displacement achieved with Expasyl gingival retraction paste, (2) evaluate the gingival displacement achieved with the TraxodentHemodent Paste Retraction System, and (3) compare the amount of lateral gingival displacement produced by the two systems.

Hypotheses

The **null hypothesis (H₀)** stated that there would be **no statistically significant difference** in the amount of lateral gingival displacement produced by Expasyl gingival retraction paste and the TraxodentHemodent Paste Retraction System. The

alternative hypothesis (H₁) stated that there would be a **statistically significant difference** in the amount of lateral gingival displacement produced by the two gingival retraction systems.

Materials and Methods

This in-vivo comparative study was conducted in the Department of Prosthodontics, Crown and Bridge, VSPM Dental College and Research Centre, Nagpur, Maharashtra, India, from January 2013 to June 2014, after obtaining approval from the Institutional Ethics Committee (IEC/VSPM'S/DCRC/P.G/PROSTHODONTICS /-20/2021).

A total sample of 30 participants with clinically healthy gingival tissues was included in the study. The primary inclusion criteria were individuals aged 20–25 years with a thick gingival biotype, healthy periodontal tissues, and no restorations in the anterior teeth.

The purpose of this in-vivo comparative study was to assess and contrast two gingival retraction systems' clinical efficacy. Thirty people with clinically healthy gingival tissues, ages 20 to 25, participated in the study. The Institutional Ethics Committee granted ethical approval, and all subjects provided written informed permission before being included in the study.

A formal sample size calculation was not performed because this was an exploratory comparative clinical study. The sample size of 30 participants was selected based on previous studies evaluating gingival displacement systems.^[5,6]

A formal a priori sample size calculation or power analysis was not performed because this was an exploratory comparative clinical study. The sample size of 30 participants was determined based on the sample sizes used in previous comparable clinical studies evaluating gingival displacement systems and the feasibility of conducting repeated clinical measurements within the study period. Consequently, no predefined effect size or attrition rate was considered during sample size determination.

A sample size of 30 participants was selected based on previous comparable clinical studies evaluating gingival displacement systems and the feasibility of conducting repeated measurements under controlled clinical conditions.

Study Design

Three groups were considered in the study:

- Group C (Control): Pre-displacement gingiva
- Group E: Post-displacement gingiva using Expasyl gingival retraction paste (Pierre Rolland, Acteon Pharma)

- Group T: Post-displacement gingiva using TraxodentHemodent paste retraction system (Premier Dental Products)

For each participant, three impressions were made:

1. Pre-displacement impression (control)
2. Post-displacement impression using Expasyl
3. Post-displacement impression using Traxodent

For each participant, all measurements were performed on the same maxillary central incisor, which served as its own control. The pre-displacement, Expasyl, and Traxodent impressions were obtained from the same tooth, with a 15-day washout period between the two gingival displacement procedures.

Inclusion Criteria

Participants aged 20–25 years with clinically healthy gingival tissues, a thick gingival biotype, and no restorations in the anterior teeth were included in the study.

Exclusion Criteria

Individuals with a thin gingival biotype, malocclusion involving the anterior teeth (such as crowding, rotation, or diastema), orthodontically treated teeth, carious teeth, restorations on anterior teeth, systemic diseases, known allergies to the study materials, or tobacco and smoking habits were excluded from the study.

Study Procedure

Impression Procedure

Diagnostic impressions were taken to create the custom tray. Pre-displacement impressions were also taken to act as the control group.

The gingival displacement technique involved the injection of the impression material into the gingival sulcus from the disto-labial to the mesio-labial line angle of the maxillary central incisor tooth (Fig 1-4). The impression material was left in position for two minutes as recommended by the manufacturer. Impressions were taken after thorough rinsing using polyvinyl siloxane monophase impression material



Fig 18. Gingival Displacement

Fig 1 Gingival displacement using exasply



Fig 19. Gingival Displacement using Traxodent Hemodent Paste Retraction System

Fig 2 Gingival displacement using Traxodent hemodent paste retrarction system



Fig 20. Making Impression with Modified Intraoral Tip

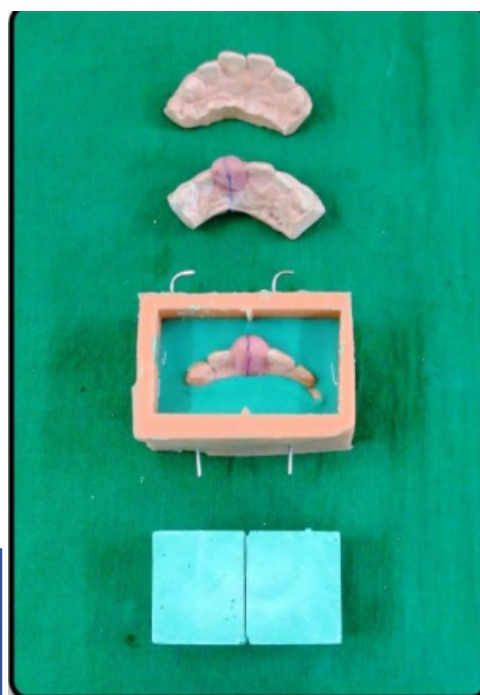


Fig 22. Cast obtained, Reinforced Cast, Embedding Model, Block Obtained

Cast Preparation

The impressions were poured immediately using Type IV dental stone. A total of 90 casts were obtained from the impressions taken. Each of the casts was sectioned in the midline of the right maxillary central incisor tooth.

Measurement of Gingival Displacement (Fig 5-9)

The sectioned casts were then subjected to examination with the aid of an optical microscope at 100 times magnification, employing image analysis software.

The linear distance between the gingival margin crests and the mid-labial tooth surfaces was determined. Three values were obtained for each of the sectioned casts, after which the mean value was determined. The final value for each of the samples was determined by averaging the values obtained for both halves of the casts

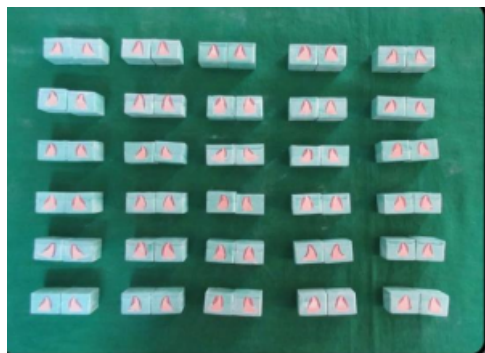


Fig 5 Samples of Control Group

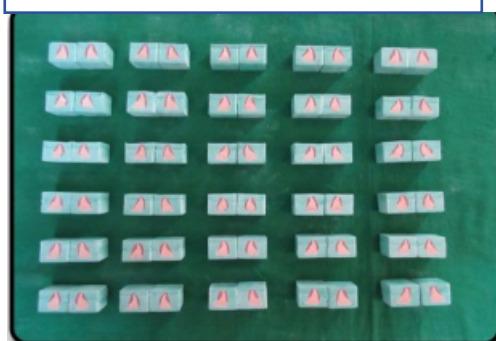


Fig 25 Samples of Expasyl Group

Fig 7 Samples of Traxodent Hemodent Retraction system Group



Fig 26. Samples of Traxodent Hemodent Paste Retraction System Group (Group T)



Fig 27. Optical Microscope (Image Analyser software)

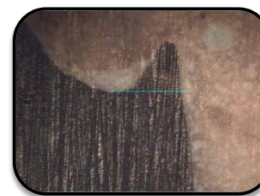


Fig 28. Measurement from the Crest of gingiva to Mid-labial Surface of tooth

By deducting the pre-displacement values from the post-displacement values, the amount of lateral gingival displacement was calculated.

The demographic parameters considered included age and gingival biotype of the participants.

Statistical Analysis

Statistical analysis was performed using STATA software version 13.1. Descriptive statistics were expressed as mean and standard deviation. Intergroup comparisons were performed using one-way ANOVA followed by Bonferroni post-hoc analysis, while paired t-test was used for comparison of lateral gingival displacement between the two experimental groups. A p-value of <0.05 was considered statistically significant.

Prior to statistical analysis, the normality of the data distribution was assessed using the Shapiro-Wilk test. Since the data were found to be normally distributed ($p>0.05$), parametric tests, including the paired t-test and one-way ANOVA, were applied for statistical comparisons.

Results

The study consisted of 30 participants. The gingival displacement caused by two different gingival retraction materials was evaluated and compared with the control group.

The mean gingival displacement in the control group (Group C) was found to be 0.15 mm. However, in all other groups, it was found to be higher.

The mean gingival displacement in Expasyl (Group E) was found to be 0.29 mm, while in Traxodent (Group T), it was found to be 0.27 mm.

The mean gingival sulcus width measured directly on the casts was 0.15 mm in the control group, 0.29 mm in the Expasyl group, and 0.27 mm in the Traxodent group. Lateral gingival displacement was subsequently calculated by subtracting the baseline (control) value from the corresponding post-displacement value.

Accordingly, the mean lateral gingival displacement was 0.14 ± 0.05 mm for Expasyl and 0.12 ± 0.05 mm for Traxodent.

Intergroup comparison was carried out using one-way ANOVA to check if there was any significant difference between the control group and experimental groups. It was found to be statistically significant ($p < 0.001$), but between the two groups, it was found to be insignificant ($p = 0.222$).

Intergroup comparison of absolute gingival displacement values using one-way ANOVA demonstrated no statistically significant difference between Expasyl and Traxodent ($p=0.222$). Comparison of mean lateral gingival displacement values using the paired t-test also revealed no statistically significant difference ($p=0.0897$).

The lateral gingival displacement caused by two different materials was evaluated and compared using a paired 't' test.

The mean lateral gingival displacement caused by Expasyl was found to be 0.14 ± 0.05 mm, while Traxodent caused 0.12 ± 0.05 mm.

The difference between the two materials was found to be insignificant ($p = 0.0897$).

These findings indicate that both Expasyl and Traxodent gingival retraction systems produced adequate gingival displacement, although no statistically significant difference was observed between the two materials.

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Table No.1
Mean, Standard Deviation, Range of Gingival Displacement
Values of 3 Groups

	Control (Group C)	Expasyl (Group E)	Traxodent Hemodent Paste Retraction System (Group T)
Mean	0.15	0.29	0.27
Standard Deviation (SD)	0.04	0.05	0.046
Range	(0.10-0.28)	(0.21-0.41)	(0.18-0.38)

Data are expressed as mean, standard deviation (SD), and range. **Group C**, Control group; **Group E**, Expasyl group; **Group T**, Traxodent Hemodent Paste Retraction System group; **SD**, Standard Deviation.

Table No. 2
Comparison of Gingival Displacement Value of 3 Groups
(Oneway ANOVA test)

F-value	78.38	
p-value	<0.001, HS	
Post hoc comparison by Bonferroni test		
Comparison	Mean difference	p-value
Group E v/s Group C	0.14	<0.001 (HS)
Group T v/s Group C	0.12	<0.001 (HS)
Group E v/s Group T	0.022	0.222 (NS)

Data were analyzed using one-way analysis of variance (ANOVA), followed by Bonferroni post hoc multiple comparison test for pairwise group comparisons. A p -value < 0.05 was considered statistically significant. **HS**, Highly significant ($p < 0.001$); **NS**, Not significant ($p \geq 0.05$); **ANOVA**, Analysis of Variance; **Group C**, Control group; **Group E**, Experimental group; **Group T**, Test group.

Table No. 3
Comparison of Lateral Displacement in
Experimental groups by Paired t test

	Mean Difference	SD	t-value	p-value
Group E – Group C	0.14	0.05	1.7559	0.0897 (NS)
Group T- Group C	0.12	0.05		

Comparisons were performed using the paired t -test. A p -value < 0.05 was considered statistically significant. **NS**, Not significant ($p \geq 0.05$); **SD**, Standard Deviation; **Group C**, Control group; **Group E**, Experimental group; **Group T**, Test group.

Discussion

Proper replication of the finish line is important for the marginal integrity and overall success of fixed prosthodontic restorations. Gingival displacement is, therefore, a significant aspect in dentistry that temporarily deflects the marginal gingiva from the tooth structure, allowing sufficient space for the impression material to flow into the gingival sulcus and replicate the preparation margins properly.¹

Mechanicochemical procedures that involve the use of gingival retraction cords soaked in hemostatic agents are traditionally accepted procedures in the displacement of the gingiva. However, this has been found to be technique-dependent and is often associated with tissue trauma, bleeding, patient discomfort, and increased chair-side time^{3,4}. Thus, in recent times, cordless gingival retraction systems have been in the spotlight, with the aim of providing a better gingival displacement technique with increased patient comfort and minimal tissue trauma to the periodontal tissue.⁷

Expasyl is a gingival retraction paste, which is composed of aluminum chloride and kaolin, allowing for both chemical hemostasis and mechanical displacement of gingival tissues. The aluminum chloride acts as both an astringent and hemostatic agent, while the kaolin component contributes to the bulk of the material, which then gently presses against the gingival tissues, thereby dilating the sulcular tissues.⁸ Traxodent Hemodent paste is another cordless gingival displacement material, which contains aluminum chloride,

allowing for gingival sulcus expansion while controlling hemorrhage.^[5,6]

In the present study, both Expasyl and Traxodent Hemodent paste showed significant gingival displacement, which was found to be much higher than that of the control group. The difference between the two groups, however, was found to be insignificant, which indicated that both of these materials can be used for gingival displacement, which is essential for making impressions.

Previous studies have shown that cordless gingival retraction systems are equally effective in producing the desired outcome in dental procedures. Gupta et al. found that paste-based gingival displacement systems resulted in adequate gingival displacement and improved handling characteristics in comparison to conventional retraction systems.⁵ Prasanna et al. found that the mean value for gingival displacement ranged from 0.26–0.27 mm in the case of the use of Expasyl, indicating that the material is capable of producing adequate gingival displacement.^[6]

It has been suggested that a minimum sulcular width of 0.2 mm is necessary to enable adequate flow of elastomeric impression materials without distortion during cast fabrication.⁹ In the present study, both materials resulted in gingival displacement values that were higher than the threshold, indicating that the materials are effective in producing the desired outcome.

Bennani and Aarts assessed the pressure exerted by cordless gingival displacement materials and found that the pressure exerted by Expasyl is adequate to produce the desired outcome without causing tissue trauma.¹⁰

Recent literature has also emphasized the increasing preference for cordless gingival displacement techniques among clinicians. Nain et al. found that paste-based retraction materials ensure predictable gingival displacement with better patient comfort than the traditional cord technique.¹¹ Recent literature has also found that cordless retraction materials ensure tissue trauma-free retraction with reduced tissue retraction time while maintaining sulcular width for impression making.^[11]

The findings of the present study are consistent with those reported by Gupta et al., who observed that paste-based gingival displacement systems produced clinically acceptable gingival retraction with improved handling characteristics compared to conventional methods[5]. Similarly, Prasanna et al reported gingival displacement values ranging from 0.26–0.27 mm with Expasyl, which closely corresponds to the mean post-displacement values observed in the present study[6]. Bennani et al demonstrated that the pressure exerted by Expasyl is sufficient to achieve effective gingival

displacement without causing significant tissue trauma, supporting the clinical applicability of the material[10]. Furthermore, recent studies by Alraheam et al. and Panwar et al. have highlighted the increasing preference for cordless gingival displacement systems due to their ease of use, patient comfort, and predictable clinical outcomes. The present findings further support these observations, as both Expasyl and Traxodent produced gingival displacement values exceeding the minimum sulcular width required for accurate impression making, with no statistically significant difference between the two materials.[27,28]

Recent investigations by Bennani et al. (2021) and Alraheam et al. (2023) have highlighted the growing preference for cordless gingival displacement techniques due to improved patient comfort and reduced tissue trauma. Similarly, contemporary evidence suggests that paste-based retraction systems provide clinically acceptable sulcular widening while minimizing periodontal injury. The findings of the present study are consistent with these observations.[10,27]

Several authors have reported favorable outcomes with paste-based cordless gingival displacement systems. Shannon, Pescatore, and Poss highlighted the clinical advantages of newer retraction materials, including ease of application and effective sulcular enlargement.^[12-14] Earlier investigations by Ferrari et al. and Bowles et al. also demonstrated that chemical gingival displacement systems can provide adequate tissue management while minimizing trauma to the periodontal tissues.^[18,19] More recent studies by Bennani et al., Alraheamet al., and Panwar et al. have further supported the clinical effectiveness and growing acceptance of cordless gingival displacement techniques in contemporary fixed prosthodontics.^[26-28]

Although Expasyl exhibited better gingival displacement than Traxodent, the difference was found to be statistically insignificant. Therefore, both materials can be considered clinically effective for gingival displacement during impression making for fixed prosthodontic treatment.

In the present study, although Expasyl demonstrated slightly greater mean gingival displacement than Traxodent, the difference was not statistically significant ($p=0.0897$). Therefore, the null hypothesis was accepted, indicating that both gingival retraction systems exhibited comparable efficacy in producing gingival displacement under the conditions of this study.

Although one-way ANOVA was used for intergroup comparisons in the present study, the

repeated assessment of the same participants under different conditions may be more appropriately analyzed using repeated-measures statistical models. Future studies should consider employing repeated-measures ANOVA to account for within-subject variability

Thus, the study findings can be used for the clinical use of paste-based cordless gingival retraction materials for gingival displacement during impression making for fixed prosthodontic treatment.

Clinical Implications:

The implications of the findings of the present study have significant clinical importance in fixed prosthodontic procedures. Gingival displacement is of primary importance in the proper recording of the finish lines of the teeth and the provision of the most satisfactory marginal fit of the restoration.

The findings of the present study revealed that both Expasyl and Traxodent gingival retraction systems have the ability to displace the gingiva by an amount greater than the minimum sulcular width required for the proper impression of the gingival tissues by elastomeric impression materials. Hence, both of the gingival retraction systems may be considered as clinically reliable alternatives to the conventional gingival cord technique of gingival displacement.

In addition, the paste-based cordless gingival displacement systems offer the advantages of patient comfort, minimization of trauma to the gingiva, and ease of handling in the provision of the gingival displacement systems. These advantages may be significant in the provision of the most satisfactory results in the routine practice of prosthodontics.

Future Perspectives

Future studies should include larger and more diverse populations with different age groups and gingival biotypes to improve the generalizability of the findings. Comparative evaluation of additional cordless gingival displacement systems, assessment of vertical gingival displacement, and long-term evaluation of periodontal tissue response would further enhance understanding of the clinical effectiveness and biological safety of these materials. Studies employing repeated-measures statistical models and digital measurement techniques may also provide more robust evidence regarding the performance of contemporary gingival displacement systems.

Study Limitations

There were certain restrictions on the current investigation. The examination was restricted to lateral gingival displacement, and the sample size was rather modest. In addition, long-term

periodontal effects of the gingival retraction materials were not assessed. **Certain potential confounding factors may have influenced the study findings. Although an attempt was made to standardize the study population by including only participants with healthy gingival tissues and a thick gingival biotype, individual variations in sulcus morphology, baseline gingival dimensions, and tissue response to displacement materials could not be completely eliminated. In addition, possible operator-related and measurement-related variations were not analyzed separately. These factors should be considered when interpreting the results of the present study.**

Furthermore, the study population was restricted to participants aged 20–25 years with a thick gingival biotype, which may limit the generalizability of the findings to other age groups and gingival phenotypes.

An additional limitation of the present study is that a single baseline measurement was used prior to the first gingival displacement procedure. Although a 15-day interval was maintained between the two interventions to allow tissue recovery, minor alterations in gingival tissue levels during the healing period cannot be completely excluded. Recording a new baseline measurement before the second intervention may have further minimized the possibility of carryover or measurement bias.

Another limitation of the present study is that examiner calibration and formal inter-/intra-examiner reliability testing were not performed. Although all measurements were carried out using a standardized protocol and image analysis software, future studies should include reliability assessment to further improve measurement consistency and reproducibility.

Conclusion

When compared to the control group, both the Expasyl and Traxodent gingival retraction systems demonstrated significant gingival displacement within the constraints of this investigation. Nevertheless, there was no discernible statistically significant difference between the two materials. For gingival displacement during **impression** procedures in fixed prosthodontics, both techniques can therefore be considered clinically effective.

Ethical Approval:

Obtained from the Institutional Ethics Committee. (I.E.C/VSPM'S/DCRC/P.G/PROSTHODONTICS/-20/2012, DATE -20/12/2021)

Conflict of Interest:

None.

Source of Funding:

None.

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