

Evaluation of occlusal pattern in periodontitis patients using T-scan analysis

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J. Adv. Pharm. Technol. Res.

ABSTRACT

Occlusal analysis is important to analyze any disharmony in occlusion. Atraumatic dental occlusion leads to evolution of T-scan. T-scan gives a valuable procedure for clinical assessment and perception of occlusal problems. T-scan can also be used in periodontitis patients for checking the occlusal pattern. Occlusal problems and periodontal disease relationship remains controversial. Further research is needed to determine whether occlusal adjustment is necessary for periodontal treatment. The main aim of the study was to assess the occlusal pattern using T-scan in periodontitis patients. Thirty periodontitis subjects were taken and checked for occlusion using T-scan. The subject's age group was 35–55 years. The study included 15 males and 15 females. Plaque index, gingival index, attachment loss, probing depth, centric occlusion (CO), protrusion, right lateral, and left lateral were the parameters studied. Occlusal adjustments were needed to decrease and dissipate the abnormal occlusal forces. The significance of statistical tests for various movements are as follows: CO (right and left) ($P = 0.077$) $P > 0.05$; protrusion (right and left) ($P = 0.09$) $P > 0.05$; left side lateral (right side and left side) ($P = 0.01$) $P < 0.05$; right lateral (right side and left side) ($P = 0.00$) $P < 0.05$. CO and protrusion (right, left) for males and females are not significant. Left lateral and right lateral (right, left) for males and females were significant. The T-scan manages adequate specificity and sensitivity. Hence, these act as a distinctive tool for diagnosis and better unreliable when used intraorally. The T-scan method is definitely a valuable tool for examining and evaluating the occlusal contacts during maximal intercuspation.

Key words: Intercuspal position, occlusion, periodontitis, t-scan

INTRODUCTION

Analysis of occlusion plays a very important role in

determining any discrepancy in occlusion. It presents a considerable difficulty in analyzing the problems which are arising from occlusal origins. The problems are due to the complex nature of the occlusal system of humans.

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Submitted: 25-Apr-2022

Revised: 20-Aug-2022

Accepted: 20-Aug-2022

Published: 30-Nov-2022

The static alignment of the incisal or occlusal areas of upper teeth or lower teeth or their counterparts is referred to as occlusion. It should be consistent and free of stress as possible. When mandibular teeth come in contact with maxillary teeth, occlusal contacts are made. It indents the dynamic morphofunctional interactions among all parts of the masticatory system.^[1]

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DOI:

10.4103/japtr.japtr_225_22

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How to cite this article: Deepika BA, Ramamurthy J. Evaluation of occlusal pattern in periodontitis patients using T-scan analysis. *J Adv Pharm Technol Res* 2022;13:S265-71.

Periodontium has the potential to withstand the force that are exerted by the tooth during occlusal contact.^[2] The adjustments in occlusion of teeth is mainly due to premature contacts or interferences. The periodontium is affected by occlusal forces in several ways, including their frequency, size, duration, and direction.^[3] The occlusal status of individual's person is mainly described by 2 major characteristics. They are as follows (a) intra-arch relationship and (b) interarch relationship.^[4]

Rationale of the study

In general, subjects with untreated chronic periodontal diseases have premature occlusal contacts leads to occlusal trauma that increase the risk of further periodontal breakdown.^[5] T-scan is extensively used as an accurate and simple method for analyzing the occlusal contact force and occlusion.^[6] In 1987, Pyakurel *et al.* delineated the development of device for occlusal analysis (T-scan system) for the past 25 years, a crucial diagnostic tool for determining the proper occlusal arrangement.^[6] T-scan promptly estimates the high points, excessive force regions, concentrations of nonuniform force, and prematurity.^[6]

Dentistry uses the T-scan system as a tool to evaluate occlusal force. Intraorally, a pressure-mapping sensor in the T-scan records the data. The parts of the system contain computer software, printer, sensor, a handle part, system assembly, and sensor. T-scan analyzes the data of occlusal contact by recording specifications, i.e., length of the bite, tooth contact force, and timing of tooth contact.^[6]

The sensor of the T-scan comes in two sizes. A large sensor can help an arch till 56 mm deep, 66 mm wide, and 1370 sensels. The miniature sensor can help an arch up to 58 mm wide and 51 mm deep and 1122 sensels. The sensor has a thickness of 0.1 mm.^[7] T-scan is more reliable and the

standardized method of occlusal evaluation. The main goal of this study was to do T-scan analysis and evaluate the occlusal pattern in periodontitis patients.

MATERIAL AND METHODS

Study design

The subjects participating in the study were those examined in the Department of Periodontics, Saveetha Dental College and Hospitals. Subjects were informed about the purpose of the study and informed consent was obtained. The study population eligibility criteria were as follows:

Ethical approval number: IHEC/SDC/PERIO/21/202.

Inclusion criteria

- Subjects with generalized chronic periodontitis
- Subjects in the age group between 35 and 55 years.

Exclusion criteria

- Smokers
- Antibiotic therapy during the final 6 months of the study
- Women who were pregnant
- Women who were breast-feeding
- Subjects who were undergoing or had received periodontal treatment within the past 6 months of the study.
- The study included 30 subjects based on the exclusion and inclusion criteria listed above. The clinical parameters are as follows: plaque index (PI), gingival index (GI), attachment loss (AL), probing depth (PD), centric occlusion (CO), protrusion (P), right lateral (R), left lateral (L).

Procedure

The subject bites on a 75 micron sensor manufactured with columns and rows which are marked with pressure

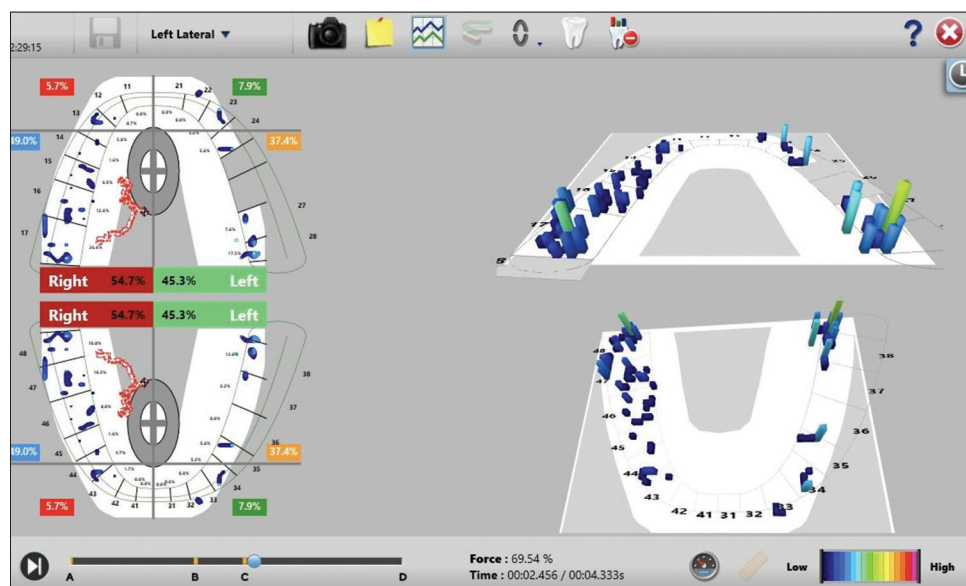


Figure 1: The image depicts the 2D and 3D view of left lateral (right, left)

sensitive ink. It is trapped in a Mylar sandwich. It scans at 1000th of a second time intervals. The sensor reads the data and is transferred to computer software. The system works on two operating modes: Force analysis and work analysis. The details about position and pattern of occlusal contacts are given by time analysis. The operator is given information regarding the relative force of tooth contact by force analysis. The bite length can be interrupted at the base of the screen sensor. The arch form is positioned in the subject's middle upper central incisors. Once the button on the handle is pressed, recording will begin. The patient is instructed to keep their mouths closed until complete intercuspation has been reached, without making any excursive motions. Request the subject to bite on the sensor with the most intercuspation possible. When the button is turned on, the arch model appears on the screen by default. As a result, the model is regarded as an exact approximation of the patient's arch and the location of the contact point on the screen. Data interpretation: The recorded information is translated into a force. The center of force's path from the start of force movements and recording to the currently visible frame is depicted by the center of force's trajectory.

RESULTS

The results are discussed in Tables 1-5 and Figures 1-8.

Paired "t" test was done using SPSS software 23.0 IBM, United States. Mean and standard deviation are given in Tables 1-5. The significance of statistical tests for Centric Occlusion (right and left) ($P = 0.077$) $P > 0.05$; Protrusion (right and left) ($P = 0.09$) $P > 0.05$; Left lateral movement (right and left) ($P = 0.01$) $P < 0.05$; Right lateral movement (right and left) ($P = 0.00$) $P < 0.05$. GI, PI, CAL, and PD are shown in detail in Figures 6-8.

CO (right and left) for females and males was not significant. Protrusion (right and left) for females and males was not significant. Left lateral (right and left) for female subjects

Table 1: The centric occlusion (right, left)

Type of Movement	Mean	SD
Right	48.99	18.85
Left	50.96	18.83

SD: Standard deviation

Table 2: The protrusion (right, left)

Type of Movement	Mean	SD
Right	43.92	19.07
Left	56.02	19.08

SD: Standard deviation

Table 3: The left lateral (right, left)

Type of Movement	Mean	SD
Right	35.67	29.06
Left	61.30	28.95

SD: Standard deviation

Table 4: The right lateral (right, left)

Type of Movement	Mean	SD
Right	74.33	25.59
Left	25.23	25.79

SD: Standard deviation

Table 5: The P value

	P
Centric occlusion (right, left)	0.77
Protrusion (right, left)	0.09
Left lateral (right, left)	0.01
Right lateral (right, left)	0.00

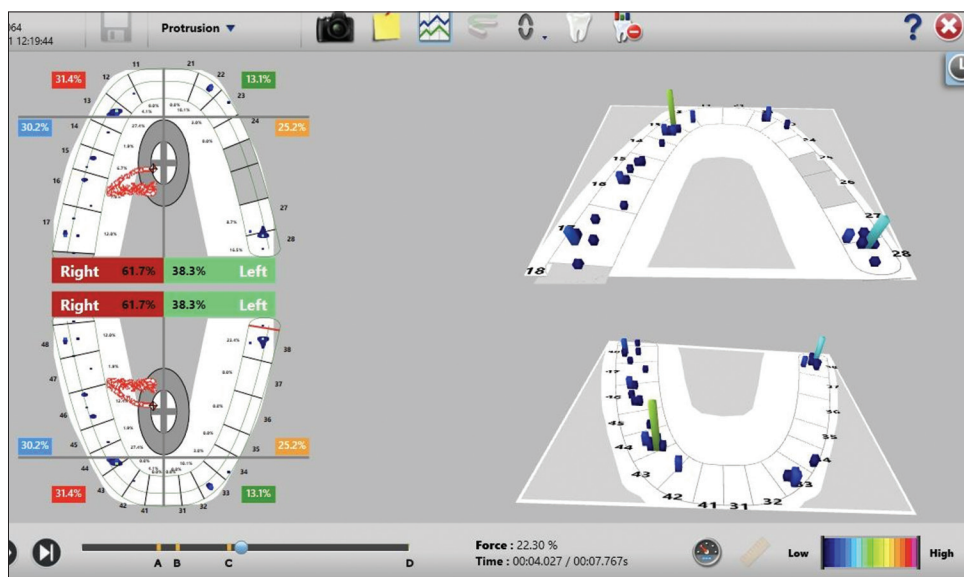


Figure 2: The image depicts the 2D and 3D view of protrusion (right, left)

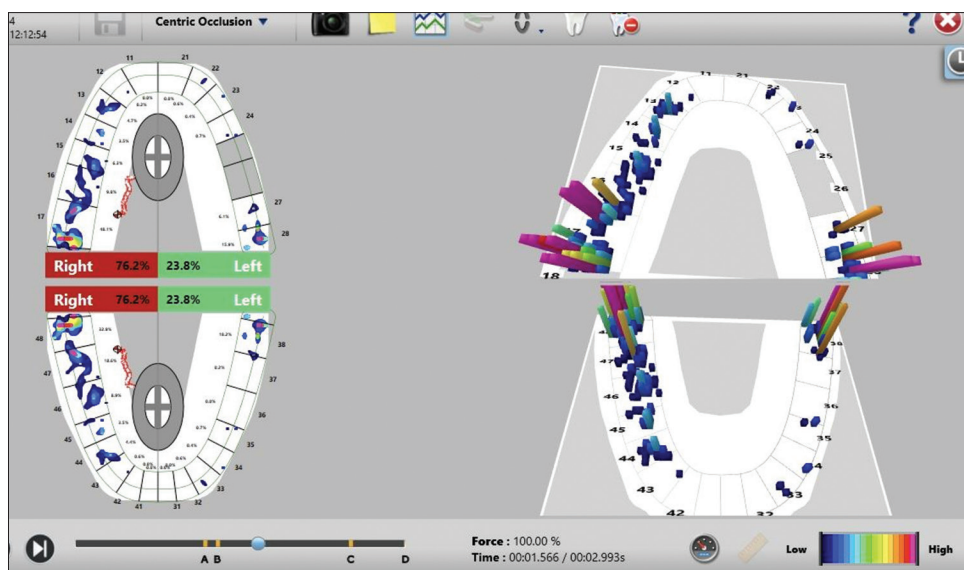


Figure 3: The image depicts the 2D and 3D view of centric occlusion (right, left)

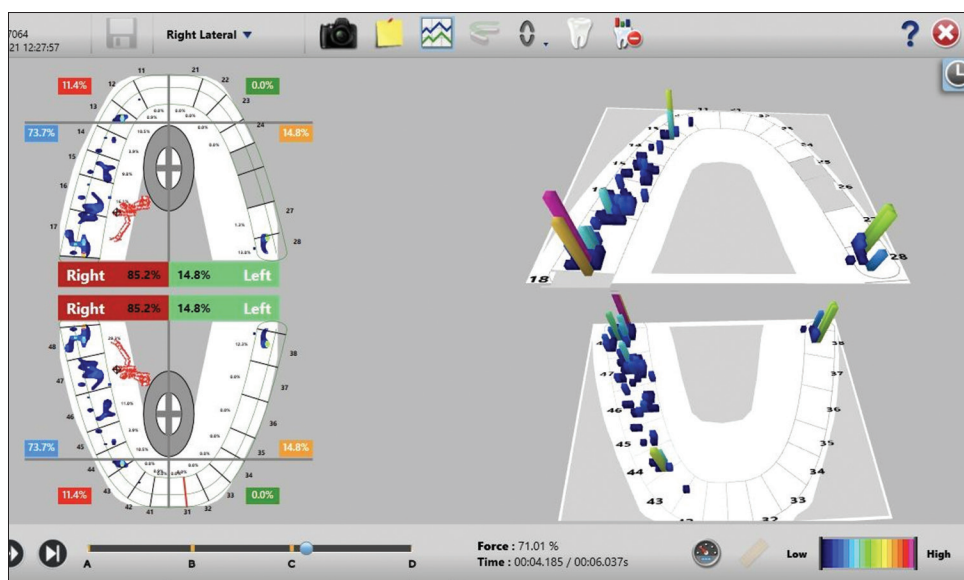


Figure 4: The image depicts the 2D and 3D view of right lateral (right, left)

and male subjects was significant. Right lateral (right and left) for females and males was significant.

DISCUSSION

Occlusal trauma is caused by occlusal stresses and results in tissue changes in the accessory structures such as the periodontal ligament (PDL), alveolar bone, and cementum.^[8] Occlusal trauma occurs in reduced periodontium. It also occurs in intact periodontium. Primary occlusal trauma: It occurs when there are normal CAL, bone levels, and also when there are excessive occlusal load.^[8] Another form of trauma from occlusion is called secondary trauma from occlusion occurs, when periodontium is weak and normal occlusal forces present, resulting in attachment and bone loss.^[8]

In a study, PDL was under severe stress once the bone support reduced more than 60%.^[9] Trauma from occlusion may involve increasing mobility of the tooth. It also leads to occlusal discrepancies/disharmonies and fremitus. A widening of the PDL space is seen on radiographs.^[10,11] Abrasion and gingival recession have long been thought to emerge as a result of excessive occlusal forces.^[12-18]

Histologically, various areas of pressure and tension are seen in the adjoining periodontium. Increased permeability, vascularization, and PDL necrosis/hyalinization, thrombosis, bleeding, and bone resorption are all pressure-related changes. The changes on the tension side are extension of the PDL fibers, cementum, and alveolar bone apposition.^[19-21] The relation between

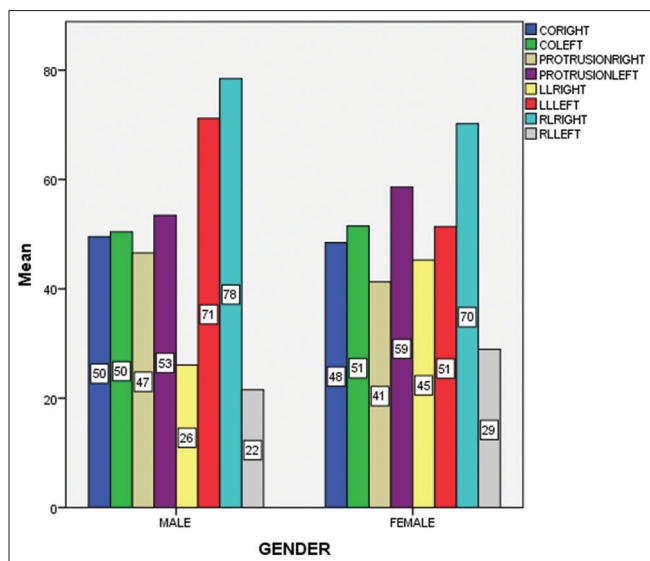


Figure 5: The graph indicates the CO: centric occlusion (right, left); PRO: Protrusion (right, left); LL: Left lateral (right, left); RL: Right lateral (right, left). Graph indicates that males showed more discrepancy in centric occlusion, protrusion and right lateral movements in right side. But females showed discrepancy in left lateral movement only

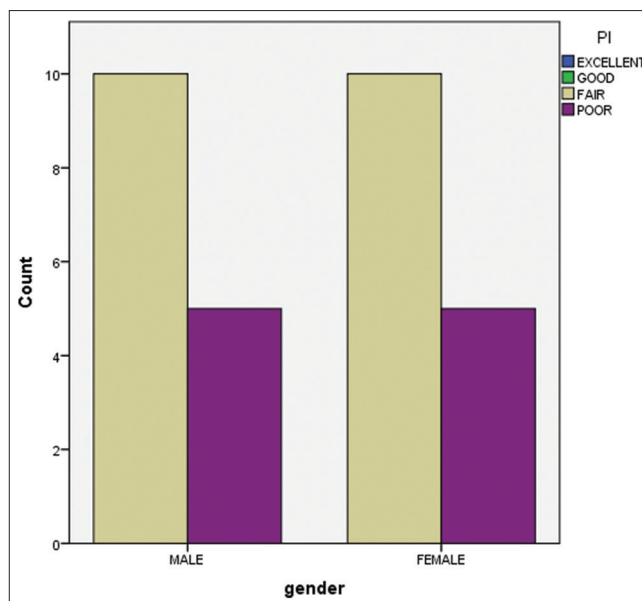


Figure 6: The graph indicates the Plaque Index for 15 male and 15 females. Plaque index mostly lies in the fair i.e., (1.0–1.9) and poor i.e., (2.0–3.0)

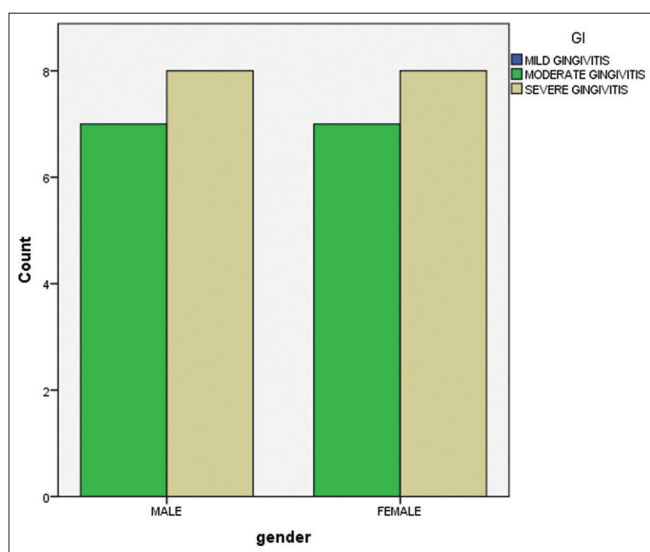


Figure 7: The graph indicates the gingival index for 15 male and 15 females. GI: Gingival index mostly lies in the moderate gingivitis, i.e., (1.1–2.0) and severe gingivitis, i.e., (2.1–3.0)

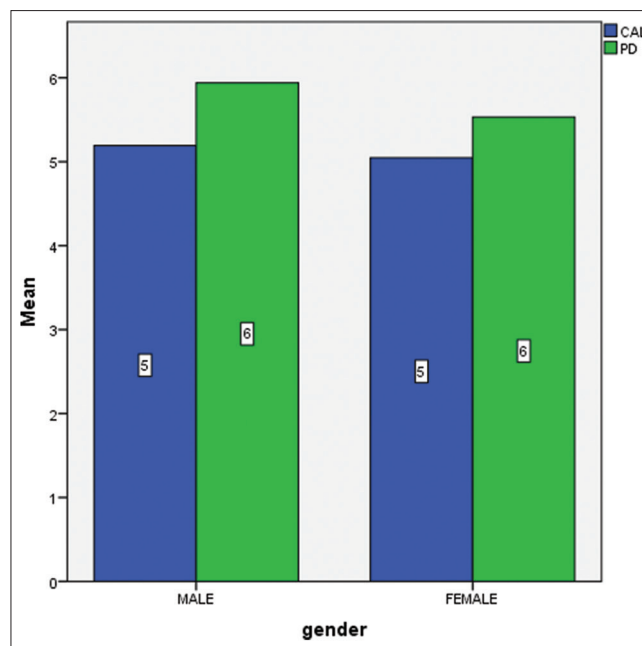


Figure 8: The graph indicates the CAL and PD between 15 male and 15 females. CAL: Clinical attachment loss; PD: Probing depth. Males showed differences in CAL and PD than females

cusps is an major agent in distributing occlusal forces to the periodontium.^[22]

In a clinical research, Lamey PJ, Lyons MF, and Sharkey SW discovered that T-scan could be used to assess the occlusal discrepancies.^[23] In Bulgaria, Kalachev accompanied a lot of research on the occlusion and its relationship with oral structures using T-scan II. It discusses the association between load of occlusion and stress of the periodontium.^[24]

Kerstein *et al.* stated that T-scan III is the most effective way for investigating and evaluating articulation and occlusal relationships.^[25]

According to Koos *et al.*, the method has a number of benefits in view of accuracy, consistency, and visibility of the dental arch.^[26] In a study by Jimoh Olubanwo *et al.*, they highlighted the importance of T-scan in determining

the occlusion both pre- and postorthognathic surgery. They discussed that T-scan is excellent for determining the occlusal disharmonies.^[27] Harrel and Nunn have proven that occlusal correction done on teeth with too many occlusal contacts was directly associated to improvement in PDs.^[28]

Karthiga, Ramamurthy *et al.* conducted a study - Association between Angles Class I Periodontal Disease. It has been demonstrated that orthodontic treatment and periodontitis are statistically significantly related.^[29]

Soundarajan and Gajendran claimed that there is a substantial correlation between alveolar bone density and occlusion.^[30] According to Bandodkar *et al.*, utilizing T-scan III, people with higher levels of depression, anxiety, and prolonged period of disocclusion may have a significant predisposition for bruxism.^[31]

The finding of this present study suggested that males showed more discrepancy in centric occlusion, protrusion and right lateral movements in right side. But females showed discrepancy in left lateral movement only.

CONCLUSION

The T-scan manages adequate specificity and sensitivity. Hence, these act as a distinctive tool for diagnosis and better unreliable when used intraorally. The T-scan method is considered a valuable tool for examining and evaluating the occlusal contacts during maximal intercuspation.

Acknowledgment

We thank Saveetha Dental College and Hospitals for providing us the support to conduct the study.

Financial support and sponsorship

The present study was supported by the following agencies.

- Saveetha Dental College
- Saveetha Institute of Medical and Technical Sciences (SIMATS)
- Saveetha University.

Conflicts of interest

There are no conflicts of interest.

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