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Color-coded occlusal contact areas and occlusal force distribution: a retrospective clinical study using TRIOS and T-Scan

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Abstract

Background

Color-coded occlusal contact maps generated by intraoral scanners are often interpreted as indicators of occlusal force distribution, although this assumption has rarely been tested. This study evaluated whether close-contact areas (yellow, orange, and red regions) on the occlusal map of an intraoral scanner (TRIOS 3) reflect the right/left occlusal force distribution recorded by a computerized occlusal analysis system (T-Scan Novus).

Methods

Records of 36 healthy young adults (23 women and 13 men; mean age, 23 ± 3 years) with complete dentition who had undergone both T-Scan recording and TRIOS scanning at maximum intercuspation were analyzed retrospectively. Close-contact areas on the maxillary occlusal maps were quantified by pixel count with ImageJ and expressed as right/left percentages of the total close-contact area. These percentages were compared with the T-Scan right/left force percentages using the paired *t*-test, Wilcoxon signed-rank test, Pearson correlation, intraclass correlation coefficients (ICC), and Bland-Altman analysis (α = 0.05).

Results

The right-side percentage was significantly higher with TRIOS (50.82 ± 2.73%) than with T-Scan (47.95 ± 7.74%) (mean difference, − 2.87 ± 8.42%; paired *t*-test, $P = 0.049$; Wilcoxon test, $P = 0.019$). Inter-device agreement was poor ($r = -0.084$, $P = 0.628$; $ICC_{2,1} = -0.048$; $ICC_{3,1} = -0.052$), and the Bland-Altman limits of agreement were wide (− 19.4% to 13.6%). T-Scan values varied considerably more between participants than TRIOS values.

Conclusions

Close-contact areas on the TRIOS color map did not reliably reflect the occlusal force distribution measured by T-Scan. A symmetric color map should not be taken to indicate balanced occlusal force; the two tools are complementary rather than interchangeable.

Background

Evaluating occlusal contacts at maximum intercuspation is a topic of long-standing clinical importance, and different methods of identifying these contacts are known to yield different numbers and patterns of contacts depending on the physical properties of the recording technique [1]. Accurate assessment of occlusal contacts and force distribution is a fundamental component of prosthodontic diagnosis and

treatment planning, influencing decisions in restorative, implant, and orthodontic therapy. Two conceptually distinct digital approaches are currently used for this purpose in clinical practice. Computerized occlusal analysis systems such as T-Scan (Tekscan Inc., Norwood, MA, USA) use a pressure-sensitive sensor to record the relative distribution and timing of occlusal force across the dental arch in real time. In contrast, intraoral scanners generate a static, color-coded occlusal contact map derived from the measured interocclusal distance between opposing surfaces at maximum intercuspation. In the TRIOS system (3Shape, Copenhagen, Denmark), this color scale is not a calibrated force or distance measurement but a qualitative visual guide, in which red and yellow/orange tones represent the smallest interocclusal distances (closest contact) and blue and green tones represent progressively greater separation [2].

As both systems assess the same clinical endpoint—maximum intercuspal occlusion—their outputs are often regarded as interchangeable in clinical practice, leading to the assumption that extensive or densely distributed contact areas on the color map correspond to high occlusal force. However, a growing body of literature suggests that this assumption is not justified. Studies comparing T-Scan with intraoral scanner–based occlusal analysis have reported that the two systems provide categorically different information [3–5], scanner-derived contact areas have shown only limited reliability [6], and a recent systematic review concluded that dynamic force analysis and static intraoral scanning are complementary rather than interchangeable tools [7].

Despite this body of work, no previous study has converted TRIOS color-coded close-contact pixel areas into normalized right/left hemi-arch percentages and compared them directly with the right/left force-distribution percentages generated by T-Scan — the format in which occlusal asymmetry is most commonly reported and clinically interpreted. Therefore, this retrospective study aimed to evaluate whether close-contact areas (yellow/orange and red zones) obtained from an intraoral scanner reflect the occlusal force distribution recorded by the T-Scan Novus system.

The null hypothesis (H0) was that there would be no significant difference and good agreement between the hemi-arch occlusal force distribution measured by T-Scan and the close-contact area distribution calculated by TRIOS.

Methods

Study design and participants

This retrospective study was approved by the Izmir Tinaztepe University Non-Interventional Research Ethics Committee (Approval No: MUKCE2025/95) and was conducted in accordance with the World Medical Association Declaration of Helsinki. At the Department of Prosthodontics, patients presenting for a routine prosthodontic examination undergo both an intraoral digital scan and a T-Scan occlusal analysis as part of the standard diagnostic protocol. The records analyzed in this study belonged to patients who had presented for such an examination, were subsequently referred to other departments

as required, and did not receive any prosthodontic treatment. Records of participants for whom both datasets were available in the digital archive were retrospectively screened for eligibility. Records dated between September 2023 and September 2024 were screened; of the 60 records with both datasets, 24 were excluded (e.g., missing teeth or active orthodontic treatment), and 36 were included. A priori sample size estimation, based on diagnostic accuracy differences reported in a comparable study, indicated a minimum requirement of 37 participants; the present study included 36 participants who met the inclusion criteria. Thirty-six healthy adults with complete permanent dentition and stable maximum intercuspation were included. Exclusion criteria were missing teeth (excluding third molars), active orthodontic treatment, temporomandibular disorders, extensive prosthetic rehabilitation, or any condition affecting occlusal function. Participants with asymmetric functional disturbances, clinical signs, or severe structural occlusal discrepancies were strictly excluded to ensure a baseline of harmonious interarch relationship. Written informed consent for the use of clinical records for research purposes had been obtained from all participants at the time of the original examination.

Digital occlusal contact analysis

Maxillary and mandibular arches were scanned using a TRIOS 3 intraoral scanner (3Shape, Copenhagen, Denmark). Digital occlusal contact maps were generated at maximum intercuspation. Maxillary occlusal contact images were exported in PNG format and analyzed using ImageJ software (National Institutes of Health, Bethesda, MD, USA).

Color-coded contact regions were segmented according to predefined hue, saturation, and brightness thresholds. Threshold values for color-based image analysis were determined manually by a team consisting of two engineers and the investigator who performed the image assessments. The team jointly reviewed the occlusal images and defined the threshold ranges for the close-contact colors to ensure consistent color selection throughout the analysis. Based on the color-coding principles reported for 3Shape occlusal maps, red and yellow/orange regions were considered to represent the closest interocclusal relationships, whereas blue and green regions indicate greater interocclusal separation and lighter or absent contact. Therefore, to focus specifically on clinically relevant close-contact areas, only yellow, orange, and red regions were included in the primary ImageJ analysis, while blue and green regions were excluded [2]. The total number of pixels corresponding to each close-contact (yellow, orange, and red) region was calculated for the right and left sides of the dental arch. The pixel count of each hemi-arch was divided by the total close-contact pixel count of both hemi-arches and expressed as a percentage. Accordingly, the right and left values represented the relative distribution of close-contact areas within the maxillary arch, with a combined total of 100%.

T-Scan occlusal force analysis

Occlusal force distribution records, obtained in the same participants at the time of their original TRIOS scan as part of the standard diagnostic protocol of the prosthodontic examination, were retrieved from

the archive. Recordings had been performed using the T-Scan Novus system (Tekscan Inc., Norwood, MA, USA), with participants seated upright and the Frankfurt horizontal plane parallel to the floor. Following sensor calibration and sensitivity adjustment according to the manufacturer's recommendations, participants had been instructed to close into maximum intercuspation with maximal biting force. Three consecutive recordings had been obtained for each participant, and the most stable maximum force-time curve and consistent center of force trajectory recording was selected by the observer for analysis. All records had been collected by the same researcher. Right and left force distribution percentages were automatically calculated by the software.

Statistical analysis

Statistical analyses were performed using SPSS (version 28.0; IBM Corp., Armonk, NY, USA). Normality of paired differences (T-Scan − TRIOS) was evaluated using the Shapiro-Wilk test ($P > 0.05$). Continuous parametric data were analyzed using the paired samples *t*-test. In addition, to account for potential sensitivity to extreme values/outliers and the inherent difference in measurement modalities (dynamic force vs. static proximity mesh), the non-parametric Wilcoxon signed-rank test was performed as a robust secondary assessment to confirm statistical agreement across parametric and non-parametric assumptions.

Inter-device agreement and reliability between T-Scan and TRIOS were quantified using intraclass correlation coefficients (ICC) [8] based on a two-way random-effects model for absolute agreement ($ICC_{2,1}$) and a two-way mixed-effects model for consistency ($ICC_{3,1}$), along with their 95% confidence intervals (CI). ICC values < 0.50, 0.50–0.75, 0.75–0.90, and > 0.90 were interpreted as poor, moderate, good, and excellent reliability, respectively. Agreement between methods was also evaluated using Pearson correlation and Bland-Altman analysis [9]. Statistical significance was set at $P < 0.05$.

Use of large language models

Claude (Anthropic, San Francisco, CA, USA), a large language model, was used to assist with organizing and drafting the manuscript text, conducting literature searches, cross-checking the statistical calculations, and preparing the figures. All statistical analyses were performed with SPSS, and all AI-assisted content, statistical outputs, and cited references were reviewed, verified, and edited by the authors, who take full responsibility for the accuracy, integrity, and originality of the work.

Results

The 36 participants (23 women and 13 men) had a mean age of 23 ± 3 years (range, 20–26 years). TRIOS recorded a significantly higher right-side close-contact percentage than the right-side force percentage recorded by T-Scan (mean difference, − 2.87 ± 8.42%; $t(35) = -2.043$, $P = 0.049$, Cohen's $d = -0.34$), and the Wilcoxon signed-rank test confirmed this difference ($W = 185.0$, $P = 0.019$) (Table 1). Because the right- and left-side percentages sum to 100% within each modality, left-side values are the

complement of the right-side values and all test statistics are identical in magnitude with the opposite sign; results are therefore reported for the right side.

Table 1
Right-side occlusal distribution percentages recorded by T-Scan and TRIOS and inter-device agreement (n = 36)

Parameter	Value
T-Scan force distribution, %[a]	47.95 ± 7.74 (33.30–76.80)
TRIOS close-contact area distribution, %[a]	50.82 ± 2.73 (45.90–58.96)
Mean difference (T-Scan − TRIOS), %[b]	−2.87 ± 8.42
Paired *t*-test	$t(35) = -2.043$, $P = 0.049$
Wilcoxon signed-rank test	$W = 185.0$, $P = 0.019$
Pearson correlation	$r = -0.084$, $P = 0.628$
$ICC_{2,1}$, absolute agreement (95% CI)	−0.048 (− 0.370 to 0.280), $P = 0.621$
$ICC_{3,1}$, consistency (95% CI)	−0.052 (− 0.374 to 0.276), $P = 0.621$
Bland-Altman mean difference (bias), %	−2.9
Bland-Altman 95% limits of agreement, %	−19.4 to 13.6
[a]Values are mean ± SD (range).	
[b]Because right- and left-side percentages sum to 100% within each modality, left-side values are the complement of right-side values (100 − right), and all statistics for the left side are identical in magnitude with the opposite sign.	
CI, confidence interval; ICC, intraclass correlation coefficient; SD, standard deviation.	

Data dispersion differed markedly between modalities, with T-Scan showing substantially greater inter-subject variability than TRIOS (standard deviation [SD], 7.74% vs. 2.73%). Pearson correlation analysis indicated no linear relationship between the two devices ($r = -0.084$, $P = 0.628$). Furthermore, intraclass correlation coefficients demonstrated poor inter-device reliability for both absolute agreement ($ICC_{2,1} = -0.048$, 95% CI: [− 0.370, 0.280], $P = 0.621$) and consistency ($ICC_{3,1} = -0.052$, 95% CI: [− 0.374, 0.276], $P = 0.621$).

In addition, Bland-Altman analysis (Fig. 1) confirmed poor agreement, with a mean difference of − 2.9 percentage points and wide limits of agreement (− 19.4% to + 13.6%). Two participants fell outside the limits of agreement: one showed a marked outlier difference (T-Scan 76.8%/23.2% vs. TRIOS close-contact 53.2%/46.8%) above the upper limit, and one fell marginally below the lower limit.

Discussion

The primary null hypothesis of this study was rejected, as close-contact areas derived from the TRIOS color map did not reliably reflect the occlusal force distribution recorded by T-Scan. The two methods differed not only in their level of agreement but also in the magnitude of the recorded right–left distribution itself: the hemi-arch distributions differed significantly, inter-device correlation and reliability were negligible, and the Bland-Altman limits of agreement were too wide for the two methods to be used interchangeably. Furthermore, the considerably greater inter-subject variability of T-Scan values than of TRIOS close-contact values indicates that the two systems respond to fundamentally different aspects of occlusal variation between individuals.

This finding is consistent with the conceptual distinction between the two technologies. The TRIOS color scale is a static, qualitative representation of interocclusal distance, in which red and yellow/orange tones indicate the smallest separation between opposing surfaces, whereas T-Scan is a dynamic, pressure-sensitive system that measures the relative magnitude of occlusal force at maximum intercuspation [2]. A widespread or symmetrically distributed close-contact area on the color map therefore indicates that many regions are separated by only a small interocclusal distance, but it does not indicate the magnitude of the occlusal force transmitted through those contacts. Several previous studies comparing T-Scan with intraoral scanner–based occlusal analysis have reported similar findings. Popa et al. [3] directly compared T-Scan III with the Medit I600 scanner and concluded that the two systems provide categorically different data that cannot be meaningfully compared on a shared scale. Shopova et al. [4] reported the same conceptual distinction between TRIOS-based contact marking and T-Scan Novus force measurement in post-orthodontic patients. Using a pixel-based color classification method similar to that employed in the present study, Bostancıoğlu et al. [5] found that T-Scan and an optical scanning system (CEREC Omnicam) consistently recorded different numbers of close-contact pixels across all color categories. Because the same classification method was applied to both systems, these findings further support the view that the observed discordance is inherent to the measurement systems rather than the analysis method itself. Comparable discordance has been reported in a three-way comparison of articulating foil, intraoral scanning, and T-Scan, in which the total number of detected contacts was similar across methods, but the location and intensity grading of individual contacts differed significantly between methods [10]. Similarly, a direct comparison between T-Scan and an optical intraoral camera system found significant differences in overlap ratios and regional reproducibility between the two systems, with T-Scan showing poorer reproducibility specifically in the anterior region [11].

The individual-level variability underlying this poor agreement can be illustrated by two representative cases (Fig. 2): in one participant, T-Scan showed a strongly right-weighted force distribution (76.8%/23.2%) driven by a single high-force contact point, while the TRIOS close-contact map appeared visually symmetric between sides; in another participant, with close agreement between the two methods (T-Scan 47.0%/53.0%; TRIOS close-contact 47.1%/52.9%), the two measures corresponded closely. Because these two cases diverge markedly in their degree of correspondence, they are unlikely

to reflect a single systematic coding error and instead suggest that T-Scan and the TRIOS color map are sensitive to partially independent dimensions of occlusal contact.

Part of the observed disagreement may also relate to the inherent measurement variability of optical contact-area assessment, independent of the conceptual difference between force and distance. Ayuso-Montero et al. [6] reported only fair-to-moderate reliability for 3D surface scan-derived contact areas (ICC 0.37–0.61), compared with better reliability for T-Scan (ICC 0.56–0.79) and physical occlusal registration (ICC 0.92–0.95), concluding that intraoral scanning alone may not be sufficiently reliable for this purpose. Similar reliability concerns have been reported for other optical and hybrid contact-marking systems, where achieving adequate validity against a reference standard required a modified, non-default evaluation strategy [12]. This suggests that some of the poor agreement observed in the present study may reflect measurement noise in the TRIOS-derived close-contact percentages rather than the force-versus-distance distinction alone.

Importantly, disagreement between T-Scan and optical methods is not a universal finding across all comparator technologies, which helps clarify the likely source of the discordance observed here. Wang et al. [13] compared T-Scan with a mechanical silicone transmission method and reported strong correlation (r = 0.73–0.81) and good Bland-Altman agreement between the two area-based measures. Because both methods in that study assessed contact area using physical or pressure-based principles, the findings indicate that T-Scan can agree well with other area-based measurement methods under appropriate conditions. Accordingly, the weak agreement observed in the present study is more plausibly explained by the comparison of a force-based measurement with an optically derived distance-based indicator than by any inherent unreliability of T-Scan. These findings carry a practical implication for clinical practice: a homogeneous or symmetric close-contact pattern on an intraoral scanner's color map should not be assumed to indicate a correspondingly balanced occlusal force distribution, and vice versa. This interpretation is consistent with the conclusion of a recent systematic review [7]. Unlike the methodologically closest study, which compared raw pixel counts by color category without hemi-arch normalization [5], the present study expressed close-contact areas as normalized right/left percentages, the format in which occlusal asymmetry is most commonly reported and clinically interpreted; this represents its principal methodological contribution.

Beyond simple color-based pixel classification, a more sophisticated computational approach to this same underlying gap has recently been explored. A pilot study trained five deep learning architectures (U-Net, ResNet-UNet, Vision Transformer, CNN-Attention, and Pix2Pix) to predict T-Scan occlusal force maps directly from intraoral scan images in 26 subjects [14]. Even the best-performing model (CNN-Attention) achieved only a modest mean structural similarity index between predicted and actual force maps (SSIM = 0.501 ± 0.030), well below the values typically targeted in natural image reconstruction tasks. Although this represents a fundamentally different analytical approach and unit of analysis from those of the present study, the modest performance achieved even with dedicated deep learning models suggests that scan-derived morphological data do not directly encode the occlusal force measured by T-

Scan, thereby independently supporting the present findings. As in the present study, the sample size was modest, and the authors themselves characterized their findings as exploratory.

This study has several limitations. First, the retrospective, single-center design and the inclusion of only healthy young adults (20–26 years) with complete dentition limit the generalizability of the findings to patients with malocclusion, missing teeth, or prosthetic rehabilitations, in whom occlusal contact patterns may differ substantially. Second, color threshold values were defined manually by a small team, and although a visual sanity check was performed comparing raw TRIOS images with their ImageJ masks in a subset of participants, some observer-dependent variability in threshold selection cannot be excluded. Third, both T-Scan and TRIOS recordings were obtained as single-session measurements; the test-retest reliability of the close-contact percentages used here was not separately assessed in this sample. Fourth, the sample size, although comparable to that of similar studies, was modest and one participant short of the a priori estimate (36 vs. 37); larger cohorts would allow more precise estimation of agreement and subgroup analyses (e.g., by sex, age, or arch form). Fifth, only a single intraoral scanner (TRIOS 3) and a single occlusal force system (T-Scan Novus) were evaluated; other scanner brands rely on different proprietary algorithms and color-mapping thresholds for occlusal contact visualization. Finally, the TRIOS 3 hardware and its occlusal-map algorithm represent an earlier scanner generation, and current systems use modified proximity thresholds for contact visualization; thus, the exact magnitude of disagreement reported here may not generalize to present-generation devices. Nonetheless, the discordance likely reflects a broader conceptual distinction rather than a device-specific artifact: color-coded contact maps infer occlusal contact from surface proximity, while T-Scan measures dynamic force via resistive sensors—two different measurands whose relationship is inherently nonlinear. Whether newer algorithms narrow this gap remains to be tested.

Conclusions

Within the limitations of this retrospective clinical study, close-contact areas derived from the TRIOS color map did not reliably reflect the occlusal force distribution measured by T-Scan. Static contact-area visualization and dynamic force analysis capture distinct dimensions of occlusal function; occlusal force balance should therefore not be inferred from the color-coded contact map alone, and the two should be used as complementary rather than interchangeable clinical tools.

Abbreviations

3D
Three-dimensional
CI
Confidence interval
CNN
Convolutional neural network
ICC

Intraclass correlation coefficient
SD
Standard deviation
SSIM
Structural similarity index

Declarations

Ethics approval and consent to participate

This retrospective study was approved by the Izmir Tinaztepe University Non-Interventional Research Ethics Committee (Approval No. MUKCE2025/95) and was conducted in accordance with the Declaration of Helsinki. Written informed consent for the use of clinical records for research purposes was obtained from all participants at the time of the original examination.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

DKA: conceptualization, methodology, investigation (data collection), software (ImageJ analysis), writing – original draft, writing – review and editing, supervision, and project administration.FE: investigation (data collection) and writing – review and editing. MHK: formal analysis (statistics) and writing – review and editing. BHŞ: formal analysis (statistics and AI usage), software, and supervision. EK: conceptualization, investigation (data collection), writing – review and editing, and project administration. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request. Participant scan records will be shared in a de-identified format, with no information that could reveal patient identity.

References

1. Qadeer S, Türp JC. Number of occlusal contacts during maximum intercuspation in dentate adults: a systematised review. J Oral Rehabil. 2023;50:617–26. https://doi.org/10.1111/joor.13451.
2. Lee H, Cha J, Chun YS, Kim M. Comparison of the occlusal contact area of virtual models and actual models: a comparative in vitro study on Class I and Class II malocclusion models. BMC Oral Health. 2018;18:109. https://doi.org/10.1186/s12903-018-0566-7.
3. Popa AD, Vlăduțu DE, Turcu AA, Târtea DA, Ionescu M, Păunescu C, Stan RS, Mercuț V. Aspects of occlusal recordings performed with the T-Scan system and with the Medit intraoral scanner. Diagnostics (Basel). 2024;14:1457. https://doi.org/10.3390/diagnostics14131457.
4. Shopova D, Bakova D, Yordanova S, Yordanova M, Uzunov T. Digital occlusion analysis after orthodontic treatment: capabilities of the intraoral scanner and T-Scan Novus system. Appl Sci (Basel). 2023;13:4335. https://doi.org/10.3390/app13074335.
5. Bostancıoğlu SE, Toğay A, Tamam E. Comparison of two different digital occlusal analysis methods. Clin Oral Investig. 2022;26:2095–109. https://doi.org/10.1007/s00784-021-04191-1.
6. Ayuso-Montero R, Mariano-Hernandez Y, Khoury-Ribas L, Rovira-Lastra B, Willaert E, Martinez-Gomis J. Reliability and validity of T-scan and 3D intraoral scanning for measuring the occlusal contact area. J Prosthodont. 2020;29:19–25. https://doi.org/10.1111/jopr.13096.
7. Dinçer G, Nogueira Chamma-Wedemann C, Reis INRD, da Silva EVF, Çakmak G, Yılmaz B, Sesma N. Comparison of digital technologies for occlusal analysis in dentate arches: a systematic review. J Dent. 2025;163:106114. https://doi.org/10.1016/j.jdent.2025.106114.
8. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. Psychol Bull. 1979;86:420–8.
9. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986;1:307–10.
10. Heuser F, Bourauel C, Stark H, Dörsam I. Clinical investigations of the comparability of different methods used to display occlusal contact points. Int J Comput Dent. 2020;23:245–55.
11. Cao R, Xu H, Lin J, Liu W. Evaluation of the accuracy of T-scan system and Cerec Omnicam system used in occlusal contact assessment. Heliyon. 2023;9:e13476.

https://doi.org/10.1016/j.heliyon.2023.e13476.

12. Popa S, Ahlers MO. Contact point marking with the OccluSense system—an in vitro study on reliability and validity. J Oral Rehabil. 2024;51:1662–74. https://doi.org/10.1111/joor.13774.
13. Wang Q, Zhao Z, Li J, Zhao R, Zhou M, Tang K, Bai S, Ma C, Wang F. In vivo evaluation of T-Scan in quantifying occlusal contact. J Oral Rehabil. 2024;51:1675–83. https://doi.org/10.1111/joor.13732.
14. Şahin CH, Bostancıoğlu SE, Ediz İ, Toğay A, Tamam E. Predicting occlusal force distribution from intraoral scans using deep learning: a pilot study. Clin Oral Investig. 2026;30:308. https://doi.org/10.1007/s00784-026-06994-6.

Figures

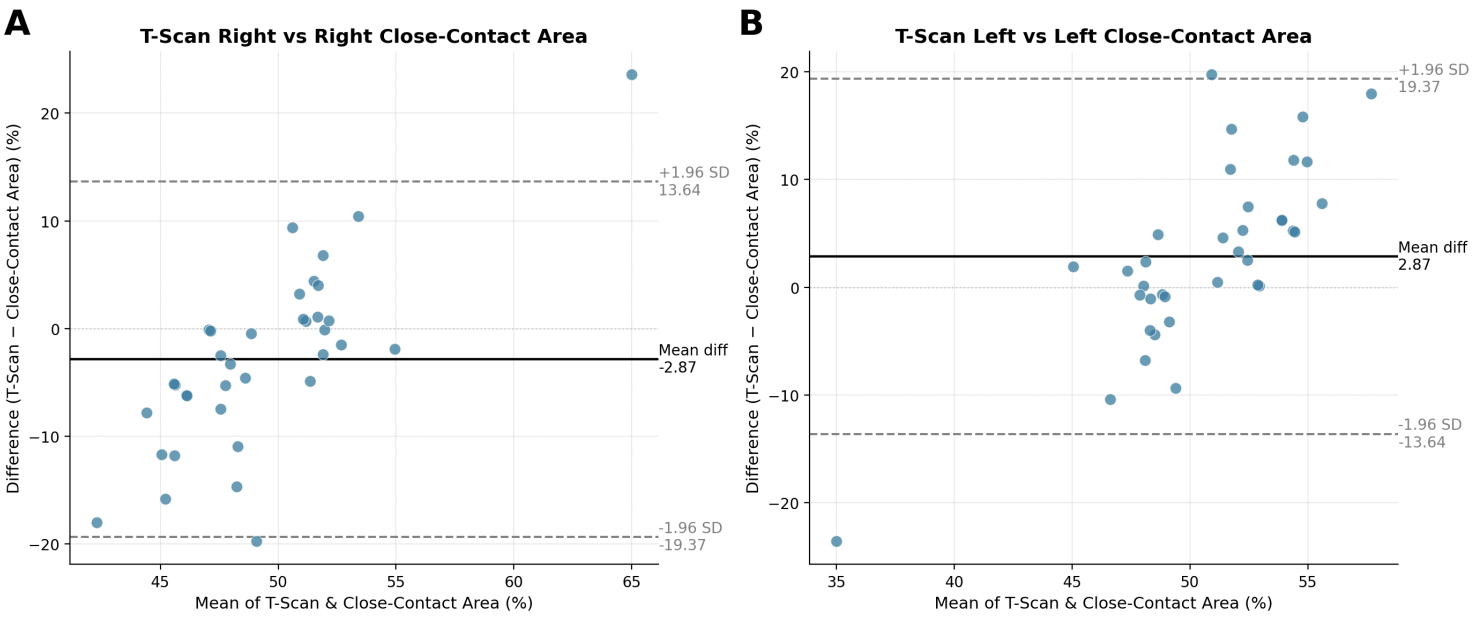


Figure 1

Bland-Altman plots of agreement between the T-Scan occlusal force distribution and the TRIOS close-contact area distribution (yellow, orange, and red regions) (n = 36). (A) Right side; (B) left side. The x-axis shows the mean of the two methods and the y-axis the difference (T-Scan − TRIOS), both as percentages. The solid line indicates the mean difference (bias), the dashed lines indicate the 95% limits of agreement (mean difference ± 1.96 SD), and the dotted line indicates zero difference. Left-side values mirror the right-side values because the right and left percentages sum to 100% within each modality.

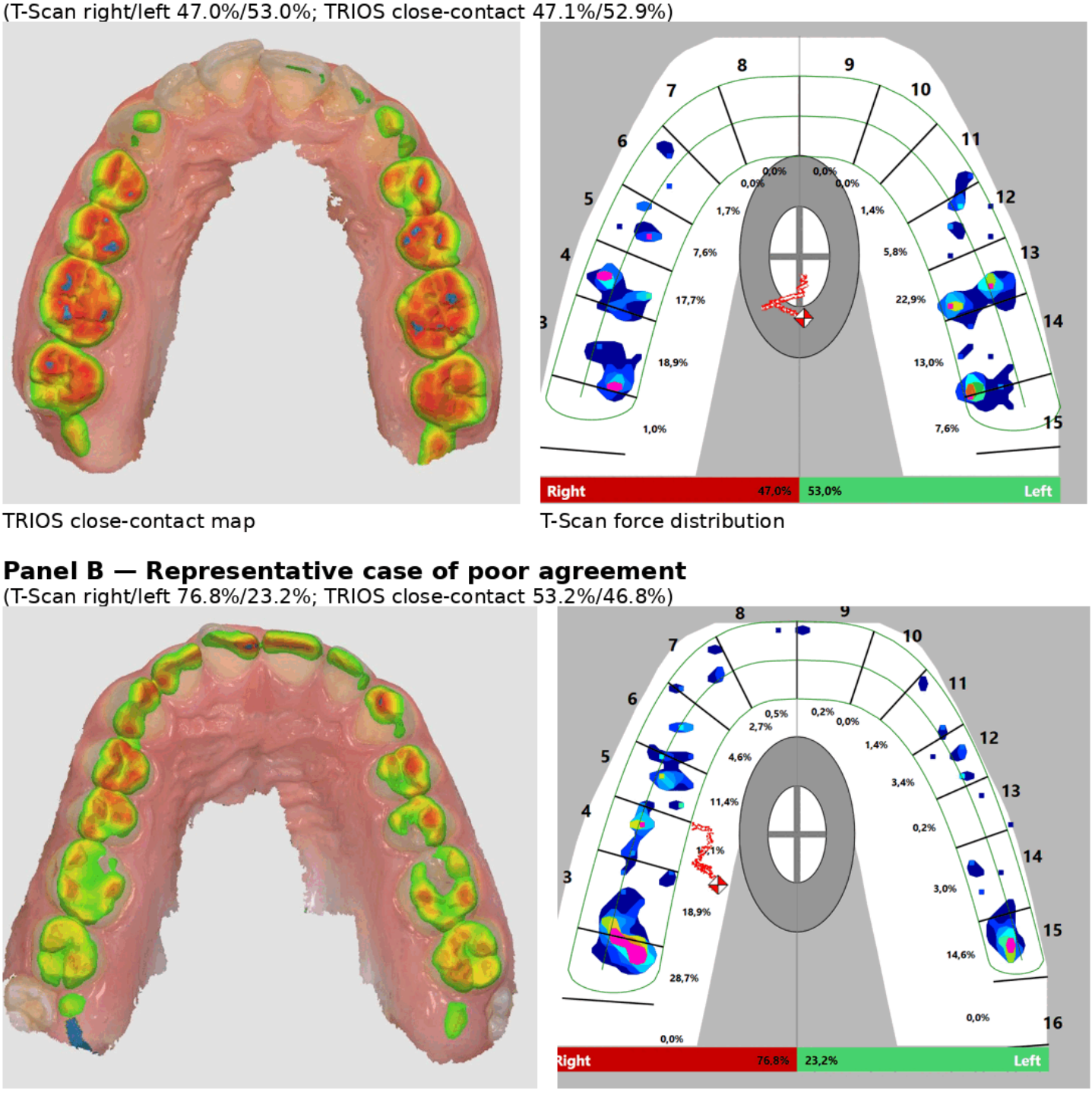


Figure 2

Representative cases of (A) close agreement and (B) poor agreement between the TRIOS close-contact map (left) and the T-Scan force distribution (right). (A) T-Scan right/left, 47.0%/53.0%; TRIOS close-contact area, 47.1%/52.9%. (B) T-Scan right/left, 76.8%/23.2%; TRIOS close-contact area, 53.2%/46.8%. In the TRIOS maps, red and yellow/orange regions indicate the smallest interocclusal distances and green regions greater separation. In the T-Scan maps, numbers indicate tooth positions (Universal

numbering system), percentages indicate the relative occlusal force on each tooth, the red trajectory indicates the center-of-force path, and the bars below show the right/left force totals.