



 Dentsply
Sirona

Primescan® Intraoral Scanners

Study Overview



Clinical Research Validating PrimeScan® Technology

As digital workflows become integral to modern dentistry, clinical validation remains essential. This collection of peer-reviewed studies (2022–2025) presents robust evidence on the performance of PrimeScan technology, covering a broad spectrum of clinical indications.

The studies span both in-vitro and in-vivo settings and evaluate PrimeScan's performance in areas such as:

- [Restorative dentistry](#): from single-unit crowns to complex prosthetic cases
- [Orthodontics](#): capturing precise anatomical detail for digital planning
- [Implantology](#): ensuring accuracy in implant positioning and fit
- [Prosthetics](#): supporting full-arch and fixed partial denture workflows
- [User experience](#): ease of use and scan efficiency
- [Comparison to traditional impressions](#): demonstrating superior accuracy and patient comfort

Across these domains, PrimeScan consistently demonstrates high trueness and precision, supporting its use in complex cases. The scanner's ability to capture detailed anatomical data with excellent accuracy contributes to improved fit, reduced adjustments, and enhanced clinical outcomes.

[Now Featuring](#): PrimeScan® 2

This collection also includes two recent studies on PrimeScan 2, which builds on the proven performance of its predecessor. These studies confirm further improvements in scan accuracy and workflow efficiency, reinforcing its role in delivering patient-centered care.

[Transparency Note](#)

This compilation represents a selected set of studies highlighting the clinical performance of PrimeScan and PrimeScan 2. While it provides valuable scientific insights, it does not encompass all available research on the technology. Additional studies exist in the broader scientific literature.

This document serves as a valuable resource for clinicians seeking data-driven insights into the performance of PrimeScan in real-world and research environments. It reflects Dentsply Sirona's ongoing commitment to advancing digital dentistry through clinically proven innovation.



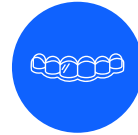
Clinical Studies Categories



Restorative



Implantology



Orthodontics



Dentures



Comparison of digital to traditional impression



User experience

Study Focus

Icons representing the primary topic explored in each study.



Depth



Multiple implant



Customer Satisfaction



Accuracy



Scan body



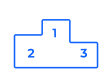
User insights



Speed



Scan pattern



The 3 Best



Full arch



Excellent crown fit



Single implant



Patient comfort

How to navigate this document:

This document has been designed with [interactive, clickable links](#) to help you navigate efficiently. Each study or page icon is clickable and takes you straight to the study summary.



Restorative

The following collection of scientific literature explores the use of intraoral scanning in restorative dentistry, featuring Primescan and benchmarking its performance against other prominent intraoral scanners.

	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
1	Accuracy of various intraoral scanners in scanning post space preparation: An in vitro study	Abouseif et al., 2025	In-vitro	Primescan provided the greatest depth coverage, highest trueness and shortest scanning time. Medit i700 matched its accuracy with slightly reduced depth and longer scan times, while Omnicam and Carestream 3700 were more limited overall.	
2	Identification of optimal gingival displacement widths, finish line depths, and preparation designs for digitally scanned single crowns	Ciou et al., 2024	In-vitro	Clinically acceptable scans with both TRIOS and Primescan required ≥ 0.3 mm displacement width and ≤ 1.0 mm subgingival depth. Primescan with ≥ 0.4 mm displacement achieved high-quality subgingival scans, and round-shoulder preparations were most accurate.	
3	Complete-arch accuracy of seven intraoral scanners measured by the virtual-fit method	Borbola et al., 2024	In-vitro	Primescan delivers extremely low marginal gaps ($\sim 42\text{--}43$ μm) for complete-arch restorations, demonstrating top-tier trueness. While its precision ranks just below the absolute best (behind Medit i700, TRIOS 5, and Emerald S), its consistent performance without the need for additional cement spacing adjustments underscores its reliability.	
4	Effect of the scanner type on the marginal gap and internal fit of two monolithic CAD/CAM esthetic crown materials: An in vitro study	Farag et al., 2024	In-vitro	Although both scanning methods yielded clinically acceptable results, the combination of Primescan and MC XL produced excellent outcomes in terms of marginal and internal fit.	
5	How do different intraoral scanners and milling machines affect the fit and fatigue behavior of lithium disilicate and resin composite endocrowns?	Pilecco et al., 2024	In-vitro	The scanning performance of Primescan and TRIOS 3 on endodontically treated teeth was compared. Primescan provided more accurate adaptation in marginal and cervical-axial angle, while TRIOS 3 performed better in axio-occlusal angle adaptation. No substantial differences were observed between the scanners in the pulpal chamber area.	
6	Comparison of the measurement error of optical impressions obtained with four intraoral and one extra-oral dental scanners of post and core preparations	Dupagne et al., 2023	In-vitro	The results showed significant performance differences between scanners, influenced by the presence of adjacent teeth and scan depth. Based on these findings, the intraoral scanners evaluated in this study appear suitable for digitizing root canal preparations.	
7	Accuracy of four recent intraoral scanners with respect to two different ceramic surfaces	Yatmaz et al., 2023,	In-vitro	Overall, Primescan and TRIOS 4 achieved the highest trueness for both materials, with Primescan demonstrating the highest precision in each case. Material type did not affect trueness for any of the scanners but had a significant impact on precision for Omnicam and VivaScan.	



	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
8	Trueness and Precision of Eight Intraoral Scanners with Different Finishing Line Designs: A Comparative In Vitro Study	Falih et al, 2022	In-vitro	Among the eight IOS tested, Medit i700 yielded the highest trueness across all finish-line designs, while Primescan and Medit i700 achieved the top precision rankings. Primescan and Heron 3 disc were the only scanners whose trueness did not differ significantly across the three finish-line designs.	
9	Beyond the surface: A comparative study of intraoral scanners in subgingival configuration scanning	Mourouzis et al., 2024	In-vitro	The accuracy of intraoral scanners decreases with increasing subgingival depth, with the magnitude of decrease varying between scanners. Across multiple depth levels, Primescan achieved results closest to the laboratory scanner, showing no significant difference at 0.5 mm and 1.5 mm, and outperforming other IOS at 4.0 mm.	
10	Digital mounting accuracy of 2 intraoral scanners with a single anterior or bilateral posterior occlusal scan: A three-dimensional analysis	Cha et al., 2023	In-vitro	Across most coordinate measurements, Primescan demonstrated higher intra-arch accuracy than TRIOS 3. The occlusal scan method influenced interarch accuracy at U1 and U2, which are located close to the coordinate origin. The scanner model influenced accuracy at U4 through U7, which lie farther from the origin.	



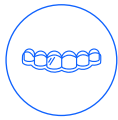
Implantology

This selection of scientific publications includes studies addressing various topics in dentistry, with a particular focus on implantology.

	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
11	Scan accuracy of recently introduced wireless intraoral scanners in different fixed partial denture situations	Dönmez et al., 2025	In-vitro	Among the tested intraoral scanners, Primescan delivered the highest overall accuracy, followed closely by Primescan 2. Both scanners generally outperformed TRIOS 3 and TRIOS 5 in 3D distance and angular accuracy, while results for inter-implant distance varied depending on the model and scanner.	
12	Update on the Accuracy of Digital Implant Impressions in 2023: A Coordinate-Based Analysis	Schmidt et al., 2025	In-vitro	Primescan achieved statistically significantly better overall trueness than all other investigated intraoral scanners. All devices reliably transferred implant positions and demonstrated improved transfer performance; however, error accumulation still increased with longer scan-path lengths.	
13	Influence of Implant ScanBody Material and Intraoral Scanners on the Accuracy of Complete-Arch Digital Implant Impressions	Azevedo et al., 2024	In-vitro	Primescan remained stable across materials. TRIOS 4, Medit i700, and iTero 5D performed better with plasma-coated titanium scan bodies. Virtuo Vivo showed higher accuracy with polyether ether ketone (PEEK) scan bodies.	
14	Trueness of Intraoral Scanners in Different Scan Patterns for Full-Arch Digital Implant Impressions	Sezer et al., 2024	In-vitro	Primescan delivered superior trueness across all patterns, achieving its best performance with the zigzag technique; TRIOS 3 performed equally with Occlusal- Palatal-Buccal (OPB) and zigzag but showed greater deviation with circular scanning.	
15	Effect of intraoral scanner and fixed partial denture situation on the scan accuracy of multiple implants: An in vitro study	Donmez et al., 2023	In-vitro	In a majority of the comparisons, both scanners showed similar performance, while Primescan achieved significantly higher accuracy in a substantial number of cases.	
16	Influence of different scan body design features and intraoral scanners on the congruence between scan body meshes and library files: An in vitro study	Michelinakis et al., 2024	In-vitro	When evaluating all tested scan bodies, Primescan yielded mean absolute deviation that were significantly less than those measured with the other scanners.	
17	Effect of Different Intraoral Scanners on the Accuracy of Bite Registration in Edentulous Maxillary and Mandibular Arches	Rutkunas et al., 2024	In-vitro	Considering the constraints of this in vitro study, scanners differed significantly in digital bite registration accuracy for edentulous arches with four implants, and only Primescan achieved results within the 100 µm clinical acceptability threshold.	
18	Effect of splinting scan bodies on the trueness of complete arch digital implant scans with 5 different intraoral scanners	Azevedo et al., 2024	In-vitro	The trueness of complete-arch digital implant scans was comparable across the conventional, splinted, and artificial landmark techniques. The performance of Primescan remained consistently high across all scan techniques.	
19	Comparison between Conventional and Digital Impressions for Determining Axes and Distances of Three Implants in Straight and Curved Lines: An In Vitro Study	Ben-Izhack et al., 2024	In-vitro	In partially dentate situations, conventional impressions and intraoral digital scans yield reliable results for straight and curved implant arrangements but curved configurations cause greater deviations with conventional impressions than with digital scans.	



	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
20	Influence of Scanbody Design and Intraoral Scanner on the Trueness of Complete Arch Implant Digital Impressions: An In Vitro Study	Meneghetti et al., 2023	In-vitro	All tested scan bodies and intraoral scanners significantly affected 3D, angular, and linear deviations between implants. Primescan outperformed the other scanners in 3D accuracy.	
21	Scan accuracy and time efficiency of different implant supported fixed partial denture situations depending on the intraoral scanner and scanned area: An in vitro study	Dönmez et al., 2023	In-vitro	Both intraoral scanners delivered statistically comparable outcomes in many of the evaluated scenarios. However, Primescan demonstrated significantly better performance than TRIOS 3 in several aspects, including 3D trueness (particularly in anterior and posterior 3-unit models), 3D precision across all models, and overall time efficiency. TRIOS 3 achieved higher precision than Primescan in buccopalatal angular deviation when partial-arch scans were performed in the posterior 4-unit model.	 
22	Comparison of 3D accuracy of three different digital intraoral scanners in full-arch implant impressions	Akkal et al., 2023	In-vitro	Primescan showed the highest trueness among the tested scanners. Variation in implant angulation led to significant differences in scan accuracy.	
23	Effect of Different Intraoral Scanners and Scanbody Splinting on Accuracy of Scanning Implant-Supported Full Arch Fixed Prosthesis	Ashraf et al., 2023	In-vitro	While there was no statistically significant difference in accuracy compared to TRIOS 4, Primescan numerically demonstrated the highest values, whereas Medit i600 was significantly less accurate.	 
24	Predictability of intraoral scanner error for full-arch implant-supported rehabilitation	Zingari et al., 2023	In-vitro	While Primescan proved to be the most precise in capturing interimplant distances, its inclination angle assessments displayed a reproducible overestimation trend, characterized by a bimodal distribution.	
25	Accuracy of 14 intraoral scanners for the All-on-4 treatment concept: a comparative in vitro study	Kaya et al, 2022	In-vitro	Among the 14 intraoral scanners tested for the All-on-4 concept, Primescan showed the highest overall accuracy, while several scanners achieved strong results in either trueness or precision, and others demonstrated lower consistency and higher deviation.	
26	Accuracy of complete-arch implant digital scans: effect of scanning protocol, number of implants and scan body splinting	Denneulin et al, 2022	In-vitro	Measurements from both intraoral scanners showed linear and angular deviations that were well inside the thresholds regarded as acceptable in clinical practice.	
27	Effect of splinting scan bodies on trueness of complete-arch implant impression using different intraoral scanners: an in vitro study	Retana et al., 2023	In-vitro	Primescan achieved the best overall trueness among the evaluated intraoral scan, with Omnicam being the only device performing at a comparable statistical level. Connecting the scan bodies generally enhanced trueness for most scanner distance combinations.	



Orthodontics

This collection of scientific publications focuses on the use of intraoral scanning in orthodontics, highlighting clinical applications, workflow efficiencies, and comparisons between digital and conventional methods.

	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
28	What to Prefer in Patients with Multibracket Appliances? Digital vs. Conventional Full-Arch Impressions—A Reference Aid-Based In Vivo Study	Bock et al., 2023	In-vitro	In orthodontic patients with multibracket appliances, digital full-arch impressions with intraoral scanners matched or exceeded the transfer accuracy of conventional alginate impressions for every measured parameter except the longest distance and required significantly less time for both impression taking and model preparation.	
29	The transfer accuracy of digital and conventional full-arch impressions influenced by fixed orthodontic appliances: a reference aid-based in vitro study	Schlenz et al., 2022	In-vitro	Intraoral scanners showed higher transfer accuracy than conventional alginate impressions in the presence of fixed orthodontic appliances, whereas conventional impressions showed the highest accuracy without fixed orthodontic appliances. All intraoral scanners were overall faster than the combined process of conventional alginate impression and conventional plaster model casting.	



Dentures

This collection of scientific publications focuses on the role of intraoral scanning in the fabrication of dentures, highlighting clinical workflow and accuracy.

	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
30	Scan accuracy of recently introduced wireless intraoral scanners in different fixed partial denture situations	Dönmez et al., 2025	In-vitro	Among the tested intraoral scanners, Primescan delivered the highest overall accuracy, followed closely by Primescan 2. Both scanners generally outperformed TRIOS 3 and TRIOS 5 in 3D distance and angular accuracy, while results for inter-implant distance varied depending on the model and scanner.	
31	Impact of the Superimposition Reference Area on Intraoral Scanning Accuracy in a Partially Dentate Maxilla	Negm et al., 2024	In-vitro	The accuracy of the scans was significantly impacted by the area used for superimposition. Primescan led in trueness and precision for palatal and edentulous regions, TRIOS 3 excelled in distal-extension trueness, and Emerald in tooth precision.	
32	Evaluation and Comparison of the Accuracy of Three Intraoral Scanners for Replicating a Complete Denture	Le Texier et al., 2024	In-vitro	The outcome of this study indicates that the choice of intraoral scanner plays a crucial role in the digital reproduction of removable complete dentures (RCD). Among the evaluated devices, Primescan delivered the most accurate results for both upper and lower removable complete denture (RCD).	
33	Effect of Different Intraoral Scanners and Scanbody Splinting on Accuracy of Scanning Implant-Supported Full Arch Fixed Prosthesis	Ashraf et al., 2023	In-vitro	While there was no statistically significant difference in accuracy compared to TRIOS 4, Primescan numerically demonstrated the highest values, whereas Medit i600 was significantly less accurate.	
34	Effect of intraoral scanner and fixed partial denture situation on the scan accuracy of multiple implants: An in vitro study	Dönmez et al., 2023	In-vitro	In a majority of the comparisons, both scanners showed similar performance, while Primescan achieved significantly higher accuracy in a substantial number of cases.	
35	Feasibility of using an intraoral scanner for a complete arch digital scan, part 2: A comparison of scan strategies	Son et al., 2023	In-vitro	Across the six intraoral scanners tested, scan strategy, scanner type, and tooth position influenced trueness, with improvements in clinically acceptable range observed only for some devices when using the second scan strategy.	



Comparison of digital to traditional impression

This selection of scientific publications explores the use of Primescan for digital impressions, with a particular focus on how it compares to conventional impression techniques.

	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
36	Accuracy Analysis of Digital Models from Intraoral Scanners and 3D-Printed Casts in Children and Teenagers	Serrano-Velasco et al., 2024	In-vitro	Although minor differences are present, digital and 3D-printed models from intraoral scans perform similarly to conventional plaster models in terms of reliability.	
37	Comparison between Conventional and Digital Impressions for Determining Axes and Distances of Three Implants in Straight and Curved Lines: An In Vitro Study	Ben-Izhack et al., 2024	In-vitro	In partially dentate situations, conventional impressions and intraoral digital scans yield reliable results for straight and curved implant arrangements but curved configurations cause greater deviations with conventional impressions than with digital scans	
38	Comparative Analysis of the Comfort of Children and Adolescents in Digital and Conventional Full-Arch Impression Methods: A Crossover Randomized Trial	Serrano-Velasco et al., 2024	In-vitro	Primescan delivered the highest patient comfort, followed by iTero, with conventional alginate impressions rated lowest in comfort in children and adolescents.	
39	What to Prefer in Patients with Multibracket Appliances? Digital vs. Conventional Full-Arch Impressions—A Reference Aid-Based In Vivo Study	Bock et al., 2023	In-vitro	In orthodontic patients with multibracket appliances, digital full-arch impressions with intraoral scanners matched or exceeded the transfer accuracy of conventional alginate impressions for every measured parameter except the longest distance and required significantly less time for both impression taking and model preparation.	
40	The transfer accuracy of digital and conventional full-arch impressions influenced by fixed orthodontic appliances: a reference aid-based in vitro study	Schlenz et al., 2022	In-vitro	Intraoral scanners showed higher transfer accuracy than conventional alginate impressions in the presence of fixed orthodontic appliances, whereas conventional impressions showed the highest accuracy without fixed orthodontic appliances. All intraoral scanners were overall faster than the combined process of conventional alginate impression and conventional plaster model casting.	
41	Accuracy of current intraoral scanning systems for full-arch impressions: An in vitro study	Buhl et al., 2025	In-vitro	Conventional impressions achieved significantly higher accuracy than all IOS; all IOS stayed <100 µm. Among IOS, Primescan was significantly better than the others, followed by Primescan 2, which was comparable to Aoralscan 3 in trueness. The three metrics were highly correlated, supporting their interchangeable use.	
42	Clinical study on the accuracy of wireless intraoral scanners for digital full arch impressions of dentate arches	MA Schlenz et al., 2025	In-vitro	In this study, Primescan 2 and Primescan AC showed no statistically significant differences in accuracy compared with the conventional impression on pooled distances.	



User experience

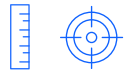
These scientific publications explore the user experience of intraoral scanning, highlighting clinician and patient perspectives, ease of use, learning curves, and workflow integration across different scanner systems.

	Study Name	Author/Date	Method Study	Summary of the Study Conclusions*	Category
43	User Experience of Intraoral Scanners in Dentistry: Transnational Questionnaire Study	Al-Hassiny et al., 2023	Survey Study	While Primescan proved to be the most precise in capturing interimplant distances, its inclination angle assessments displayed a reproducible overestimation trend, characterized by a bimodal distribution.	
44	Scan accuracy and time efficiency of different implant supported fixed partial denture situations depending on the intraoral scanner and scanned area: An in vitro study	Dönmez et al., 2023	In-vitro	Both intraoral scanners delivered statistically comparable outcomes in many of the evaluated scenarios. However, Primescan demonstrated significantly better performance than TRIOS 3 in several aspects, including 3D trueness (particularly in anterior and posterior 3-unit models), 3D precision across all models, and overall time efficiency. TRIOS 3 achieved higher precision than Primescan in buccopalatal angular deviation when partial-arch scans were performed in the posterior 4-unit model.	



Accuracy of various intraoral scanners in scanning post space preparation: An in vitro study

Abouseif et al.,
2025, Alexandria University Egypt



Study Background

Evaluated the scanning depth, trueness, and scan time for digital impressions of post space preparations.

Used a human maxillary canine prepared for post and core restoration and the scan was performed on maxillary typodont mounted in dental simulation mannequin.

Compared four intraoral scanners (Primescan, Medit i700, Omnicam, Carestream 3700) using a conventional impression as the reference standard.

Measurements included 3D analysis of STL files with RMS error calculations and timed scanning procedures.

Key Findings

- Primescan achieved an average scanning depth of 18.07 mm, nearly capturing the full depth of the post space.
- In contrast, Medit i700 reached about 9.96 mm, while Omnicam and Carestream 3700 only captured 7.13 mm and 7.31 mm, respectively.
- Primescan achieved a significantly greater scan depth compared to Medit i700, Carestream 3700, and Omnicam, while Carestream 3700 and Omnicam did not differ significantly from each other.
- Accuracy was assessed using RMS error values at different depths.
- At deeper levels (e.g., 9.5 mm), Primescan showed significantly lower RMS values compared to Medit i700, indicating higher accuracy.
- Primescan demonstrated the shortest scanning time at approximately 33.67 seconds, which was significantly faster than the other scanners ($P < 0.001$).

[Read the Complete Study](#)



Scan accuracy of recently introduced wireless intraoral scanners in different fixed partial denture situations

Dönmez et al., 2025,
University of Bern, Switzerland



Study Background

This study compared the scan accuracy of Primescan 2 and TRIOS 5 (wireless) against Primescan and TRIOS 3 (wired) in various fixed partial denture (FPD) situations.

Test models: Three maxillary test models exhibiting partial edentulism with implants positioned at various anatomical locations (anterior and posterior FPD scenarios).

Accuracy metrics: 3D distance deviations, angular deviations, and 2D interimplant distance deviations.

Statistical analysis: Bootstrap ANOVA and Holm-corrected Welch tests (significance level $\alpha = 0.05$).

Key Findings

- Primescan 2 (wireless) showed high accuracy (low 3D distance deviations), performing comparably to Primescan in both anterior and posterior FPD scenarios.
- Primescan consistently achieved the best angular accuracy and generally the best interimplant distance accuracy across the tested scenarios.
- TRIOS 3 outperformed TRIOS 5 but showed lower overall accuracy than Primescan.
- TRIOS 5 exhibited the highest overall deviations, particularly in angular accuracy, making it the least accurate in this comparison, except for interimplant distance accuracy in Models 1 and 3, where it outperformed Primescan 2.
- Although both wired and wireless scanners were included, factors such as WiFi stability or battery levels were not systematically tested, so any differences may not be attributed solely to wireless connectivity.

[Read the Complete Study](#)



Update on the Accuracy of Digital Implant Impressions in 2023: A Coordinate-Based Analysis

Schmidt et al., 2025,
Justus-Liebig-University, Gießen, Germany



Study Background

Study investigated the accuracy of digital implant impressions using four modern intraoral scanners (IOS).

Implant master model (IMM) with four implants used to simulate a partially edentulous maxilla.

Datasets from Primescan, Medit i700, TRIOS 4, and TRIOS 5 from 3Shape compared against a reference generated via computed tomography.

Ten scans per IOS, deviations at implant-abutment-interface points (IAIPs) analyzed.

Key Findings

- With a mean deviation of $88 \pm 47 \mu\text{m}$, Primescan achieved the highest overall trueness among the four devices tested.
- Medit i700 exhibits significantly inferior precision, as its measurements are less consistent.
- Errors increase with longer scan paths, which is particularly clinically relevant for full-arch impressions.
- There was little to no improvement observed between the two TRIOS versions (TRIOS 4 and TRIOS 5).
- When analyzing individual implant positions, only one position showed a statistically significant difference.

[Read the Complete Study](#)



Trueness and Precision of Eight Intraoral Scanners with Different Finishing Line Designs: A Comparative In Vitro Study

Falih et al, 2022,
Baghdad University, Iraq



Study Background

- Aim:
 - To compare intraoral scanners (IOS) in trueness and precision.
 - To evaluate the influence of three finish line designs.
- Each of the three printed maxillary arch models contained a maxillary right first molar prepared with different finish-line designs.
- Finish line designs used chamfer, shoulder, and vertical preparation.
- Investigated IOS: Medit i700, Planscan Emerald S, Primescan, TRIOS 3, CS3600, Medit i500, Heron 3Disc, Omnicam.
- Reference scan was made with a lab scanner (Medit T710).
- Evaluation of trueness and precision by using a 3D inspection software (Medit compare), best fit alignment.

Key Findings

- For Primescan and the Heron 3Disc, trueness did not vary significantly across the chamfer, shoulder, and vertical finish-line designs, whereas precision showed significant differences between these designs.
- For trueness, Primescan showed significant differences compared with most other scanners for chamfer and shoulder designs, while no significant differences were found against any scanner for the vertical design. In shoulder preparations, it achieved the second-best result among all scanners.
- For precision, Primescan ranked first for chamfer and vertical preparations and second for shoulder preparations, with no significant differences compared to the Medit i700 in any finish-line design, while both outperformed all other scanners.

[Read the Complete Study](#)



Beyond the surface: A comparative study of intraoral scanners in subgingival configuration scanning

Mourouzis et al., 2024,
Aristotle University of Thessaloniki, Greece



Study Background

- The study compared three intraoral scanners (IOS) (Primescan, TRIOS 3, Omnicam) with the inEos X5 laboratory scanner under simulated subgingival conditions, quantifying trueness by comparing the cavity surface area measured from the digital scans to the known reference area.
- 100 resin specimens with rectangular subgingival cavities (depths 0.5, 1, 1.5, 2, 4 mm) were mounted in a typodont on a dental simulation mannequin.
- Scanning followed two set-ups:
 - Fixed mode: the scanner was clamped in a custom parallelometer for precise, repeatable positioning.
 - Clinical simulation: an operator hand-held the scanner on a mannequin to mimic real treatment.
- Both modes used the identical standardized scan path, kept the room at 1 000 lux, and recalibrated the scanner after every ten scans.

Key Findings

- A significant scanner × depth interaction indicates that the influence of preparation depth on accuracy differs substantially between scanners.
- The desktop reference scanner (inEos X5) achieved the highest mean accuracy at every tested depth.
- Primescan matches the lab scanner at 0.5 mm and 1.5 mm depths (no significant difference).
- TRIOS 3 also matches the lab scanner at 2 mm depth, accuracy then drops.
- At the challenging 4 mm depth, all intra-oral scanners showed a marked loss in trueness. Primescan performed best among IOS, significantly outperforming TRIOS 3 and Omnicam, but remained behind the lab scanner.
- Omnicam shows the steepest loss in trueness from 1.5 mm downward, reproducing barely half of the 4 mm surface.

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Digital mounting accuracy of 2 intraoral scanners with a single anterior or bilateral posterior occlusal scan: A three-dimensional analysis

Cha et al., 2023,

Yonsei University College of Dentistry, Seoul, Republic of Korea



Study Background

- The study examined how Primescan and TRIOS 3 differ in their 3D mounting accuracy when using either a single buccal scan of the front teeth or bilateral buccal scans of the back teeth, all performed with the jaws in full occlusion.
- Epoxy jaw casts, with the lower first molar removed, were equipped with fourteen zirconia spheres and three 10 mm PEEK cubes, and the cube placed buccally at the edentulous site defined the coordinate origin.
- Fifteen full scan datasets were collected for each of the four experimental conditions (Primescan vs. TRIOS 3 combined with either an anterior or bilateral buccal scan), with each dataset including a complete maxillary arch scan, a complete mandibular arch scan, and the corresponding buccal scan.
- Both IOS devices captured full-arch scans, and the resulting deviations were measured using a coordinate-measuring machine and analyzed with dedicated software.

Key Findings

- Intra-arch trueness: Primescan showed significantly smaller coordinate deviations than TRIOS 3 at almost every mandibular sphere (x, y, z); only at dyL1, dzL1, dyL2 and dyL3 were the difference not statistically significant.
- Error growth along the arch: For both scanners the 3-D deviation (dL) increased the farther a sphere lay from the origin, but the rise was consistently lower with Primescan.
- Maxillary (dU) accuracy pattern: For the spheres nearest the coordinate origin (U1 - U2), a bilateral-posterior occlusal scan reduced the 3-D deviation with both scanners. For spheres located farther along the arch (U4 - U7), Primescan yielded significantly smaller 3-D deviations than TRIOS 3, irrespective of the occlusal-scan type.
- Primescan tended to bring the upper and lower arches closer together in both the front and back regions, whereas TRIOS 3 widened the gap in the anterior area but narrowed it in the posterior.

[Read the Complete Study](#)



Identification of optimal gingival displacement widths, finish line depths, and preparation designs for digitally scanned single crowns: An in vitro study

Ciou et al., 2024,
Kaohsiung Chang Gung Memorial Hospital, Taiwan



Study Background

- Investigates optimal gingival displacement widths, finish line depths, and preparation designs for digitally scanned single crowns.
- Aims to establish criteria for achieving clinically acceptable and high-quality digital impressions.
- Compares two intraoral scanners (Primescan and TRIOS 3 from 3Shape) using CAD/CAM-fabricated abutments with varying designs and simulated gingival conditions.
- Data collection involved performing a total of 600 scans (5 repeats each condition), where four different gingival displacement widths and five finish line depths were applied on three different abutment preparation designs.
- Reference: Standard scans of prepared abutments without simulated gingiva used for 3D superimposition.
- 3D metrology software computed tangent distance for marginal discrepancies and marginal angle difference for angular deviations.

Key Findings

- There's a significant linear relationship showing that as displacement width increases and finish line depth decreases, discrepancies diminish.
- The highest accuracy was achieved with the round-shoulder preparation.
- Both TRIOS 3 and Primescan consistently produced high-quality scans for supragingival finish lines ("high-quality" scans are those with a tangent distance $\leq 50 \mu\text{m}$ and no significant marginal angle differences.)
TRIOS 3 did not produce high-quality scans when finish lines were located subgingivally.
- Primescan achieved high-quality scans in the subgingival region under these conditions:
0.4 mm gingival displacement at a finish-line depth of -0.5 mm and 0.5 mm gingival displacement at finish-line depths of -1.5 mm, -1.0 mm, and -0.5 mm.

[Read the Complete Study](#)



Complete-arch accuracy of seven intraoral scanners measured by the virtual-fit method

Borbola et al., 2024,
Semmelweis University, Budapest, Hungary



Study Background

Objective: Seven intraoral scanners were directly compared for their fit accuracy on full-arch restorations via the virtual-fit technique, focusing on marginal and internal gap measurements under both standard (70 μm) and extended (70 + 20 μm) spacings.

Scanners tested: Aoralscan3, Emerald S, Helios600, Lumina, Medit i700, Primescan, and TRIOS 5.

On every intraoral scan, two full-arch fixed frameworks were created (one with a 70 μm internal cement space and one with a 90 μm internal cement space, achieved by adding 20 μm at the margin).

Scans were aligned with reference models using the virtual-fit method to simulate clinical try-ins.

Precision and trueness were measured based on marginal and internal gaps.

Statistical analyses included Kruskal-Wallis and Wilcoxon tests.

Key Findings

- In group 70, Medit i700, Primescan, and Emerald S all achieved exceptionally low marginal gaps (approximately 42–43 μm), demonstrating excellent trueness without the need for additional cement spacing adjustments.
- In terms of reproducibility, Primescan ranks in the second-best group, following Medit i700, TRIOS 5, and Emerald S, indicating strong consistency.
- Although Primescan's precision is slightly lower compared to the top homogeneous group, its overall performance remains highly reliable.
- In contrast, scanners such as Lumina and Aoralscan 3 showed significant improvements with increased cement spacing (group 70+20).

[Read the Complete Study](#)



Accuracy Analysis of Digital Models from Intraoral Scanners and 3D-Printed Casts in Children and Teenagers

Serrano-Velasco et al., 2024,
Universidad San Pablo-CEU, Madrid, Spain



Study Background

The study investigated the accuracy of digital models and 3D-printed casts compared to conventional plaster casts in children and adolescents.

It was a monocentric, controlled, crossover reliability study with 51 participants (mean age 12.35 ± 2.57 years), where intraoral measurements served as the reference standard against which digital models (iTero and Primescan) and 3D-printed casts (via Digital Light Processing) were compared.

Key measurements, including intercanine, intermolar, and canine–molar distances, were analyzed using paired comparisons and one-way repeated measures ANOVA.

Key Findings

- This study validated the hypothesis that digital and 3D-printed techniques match the conventional method in terms of reliability and accuracy.
- Digital and printed models slightly underestimated upper arch dimensions and overestimated lower arch ones, but all deviations stayed below 1 mm and were deemed clinically negligible.
- Digital, 3D-printed, and plaster models all aligned closely with intraoral measurements, showing statistically significant positive correlations.

[Read the Complete Study](#)



Influence of Implant ScanBody Material and Intraoral Scanners on the Accuracy of Complete-Arch Digital Implant Impressions

Azevedo et al., 2023,
University of São Paulo, Brazil



Study Background

In vitro study assessing the accuracy of complete-arch digital implant impressions.

Reference model: Mandibular edentulous cast with six implant analogs.

Scan body materials compared: Polyether ether ketone (PEEK) vs. plasma-coated medical titanium.

Intraoral scanners tested: Primescan, TRIOS 4, Virtuo Vivo, Medit i700, and iTero Element 5D.

Accuracy metrics: Trueness and precision (evaluated via 3D deviation measurements).

Statistical analyses: Kruskal-Wallis tests with Bonferroni corrections (or ANOVA when applicable), with $P < .05$ as significance level.

Key Findings

For PEEK scan bodies:

- Primescan showed significantly better trueness than TRIOS 4, but there was no significant difference compared to iTero 5D, Virtuo Vivo, or Medit i700.
- In terms of precision, Primescan was significantly more precise than TRIOS 4 and iTero 5D, but not significantly different from Virtuo Vivo or Medit i700.
- Virtuo Vivo also demonstrated strong results in both trueness and precision and performed close to Primescan.

For plasma-coated medical titanium scan bodies:

- For trueness, Primescan was significantly more accurate than Virtuo Vivo, but showed no significant difference compared to TRIOS 4, iTero 5D, or Medit i700.
- For precision, there were no statistically significant differences among Primescan, TRIOS 4, iTero 5D, Medit i700, and Virtuo Vivo— all scanners demonstrated comparable results.

Overall:

- The accuracy of the scans was significantly influenced by how the scanner interacted with the specific scan body material.
- While statistical significance was not observed in every pairwise comparison, Primescan demonstrated the highest mean accuracy across both PEEK and titanium scan bodies, unaffected by material variation.

[Read the Complete Study](#)



Trueness of Intraoral Scanners in Different Scan Patterns for Full-Arch Digital Implant Impressions

Sezer et al., 2024,
Erciyes University, Kayseri, Turkey



Study Background

Evaluate how different scan patterns affect the trueness of intraoral scanners (IOS) used for full-arch digital implant impressions.

A maxillary plaster model with 4 implant analogs was used.

The scan bodies were affixed to the implant analogs and digitized using a laboratory scanner to obtain the reference data.

Primescan and TRIOS 3 were used to capture scans.

Three patterns were evaluated: Occlusal-Palatal-Buccal (OPB), Circular and Zigzag.

Continuous scans from a fixed start with 10 repeats per group, following calibration and cooling breaks.

Best-fit superimposition to measure 3D distance and angular deviations, analyzed using ANOVA and t-tests ($p=0.05$).

Key Findings

- The most suitable scan pattern for full-arch digital implant impressions may differ based on the intraoral scanner being used.
- Among the scan patterns tested with the Primescan, the zigzag technique resulted in the lowest 3D deviation.
- OPB and zigzag scan patterns showed comparable 3D accuracy for TRIOS 3, whereas the circular pattern resulted in significantly greater deviation.
- Across all scan patterns, the Primescan demonstrated higher trueness than the TRIOS 3.
- The scan patterns produced significantly different 3D distance deviations for TRIOS 3 and Primescan.
- Angle deviations varied significantly between scan patterns in the Primescan, but not in the TRIOS 3.

[Read the Complete Study](#)



Effect of the scanner type on the marginal gap and internal fit of two monolithic CAD/CAM esthetic crown materials: An in vitro study

E.A.A. Farag et al., 2024,
British University in Egypt, Cairo



Study Background

This research explored the extent to which intraoral and extraoral scanning methods affect the internal and marginal accuracy of monolithic CAD/CAM crowns made from two distinct materials.

Scanners tested: Primescan and inEos X5.

Materials: Tetric CAD (Ivoclar Vivadent) and BRILLIANT Crios (Coltène/Whaledent).

Models: 40 resin-printed dies divided into groups based on crown material and scanning technique.

Metrics assessed: Marginal gap and internal fit.

Statistical analysis: Mann-Whitney U test (significance level $p < 0.05$).

Key Findings

- The type of scanner had a significant influence on the marginal gap for both materials. However, the crown material only made a significant difference when scanned with the inEos X5. With Primescan, no material-dependent variation was observed.
- The scanner type significantly influenced the internal fit for both materials, with Primescan yielding lower values than inEos X5. However, the choice of crown material did not result in any statistically significant difference, regardless of the scanner used.

[Read the Complete Study](#)



Influence of different scan body design features and intraoral scanners on the congruence between scan body meshes and library files: An in vitro study

Michelinakis et al., 2024,
Private Practice, Heraklion and Athens, Greece



Study Background

To assess the influence of implant scan body (ISB) design features and different intraoral scanners (IOS) on the congruence between ISB mesh files (MF) and their corresponding library files (LF).

An in vitro study using a 3D-printed maxillary cast with 4 different implant scan bodies (Straumann, MIS, Paltop, TRI).

Scanner tested: Primescan, TRIOS 3, TRIOS 5, Medit i700, Fussen S6000, Runyes 3DS and Dental Wings 7series.

Congruence was evaluated via absolute deviation using a metrology software (CloudCompare) and analyzed with ANOVA.

Key Findings

- Primescan recorded the lowest overall mean absolute deviation across all scan bodies and was statistically significantly more accurate than every other scanner tested.
- There was a significant interaction between scanner model and scan body design, indicating that each scanner's accuracy depended on which scan body was used.
- The simpler, cylindrical scan bodies (STR and MIS) produced lower deviations on average across all scanners than the more complex models (PLT and TRI).

[Read the Complete Study](#)



Effect of Different Intraoral Scanners on the Accuracy of Bite Registration in Edentulous Maxillary and Mandibular Arches

Rutkunas et al., 2024,
Vilnius University, Lithuania



Study Background

The study tested if intraoral scanning systems accurately register interarch relationships on edentulous models with implant scan bodies.

3D-printed edentulous maxillary and mandibular models were produced using an Asiga Max UV printer based on Frasco model designs.

Four dental implants were symmetrically placed in each model using Straumann BLT RC implants, with scan bodies attached using a standardized 15 Ncm torque.

To enable measurement of the spatial relationship between the upper and lower arches, each model's base was outfitted with five metrological spheres acting as reference markers.

Digital impressions and bite registrations were obtained using four different intraoral scanners: Primescan, TRIOS 3, TRIOS 4, and Medit i500, with 10 scans performed for each scanner.

STL data were analyzed in Geomagic Control X to measure sphere distances for trueness and precision.

Key Findings

- Primescan achieved the lowest deviations in both trueness and precision, remaining within clinically acceptable limits ($<100\text{ }\mu\text{m}$).
- Medit i500 and TRIOS 3 showed intermediate values with no significant difference between them, while TRIOS 4 had the highest deviations.
- Pairwise comparisons revealed statistically significant differences ($p < 0.05$) for most device comparisons, except between Medit i500 and TRIOS 3.

[Read the Complete Study](#)



How do different intraoral scanners and milling machines affect the fit and fatigue behavior of lithium disilicate and resin composite endocrowns?

Pilecco et al., 2024,
Universidade Federal de Santa Maria, Brazil



Study Background

Aim: Assess influence of intraoral scanners, milling machines, and restorative materials on restoration fit and mechanical performance of CAD/CAM endocrowns.

Metrics Assessed: Marginal/Internal fit, Cervical-axial angle adaptation, axio-occlusal angle adaption, pulpal angle adaptation, pulpal space fit, fatigue failure load (FFL), number of cycles to failure (CFF).

Intraoral Scanners: TRIOS 3, Primescan.

Milling Machines: CEREC MC XL (4-axis), PrograMill PM7 (5-axis).

Restorative Materials: Lithium disilicate (IPS e.max CAD, Ivoclar), Resin composite (Tetric CAD, Ivoclar).

Key Findings

- Primescan intraoral scanner and CEREC milling machine demonstrated superior adaptation at both the cervical-axial angle and the margin. While marginal fit was also influenced by the restorative material, with resin composite performing better, no material-related differences were observed at the cervical-axial angle.
- TRIOS 3 yielded the best adaptation at the axio-occlusal angle, regardless of milling machine or material.
- Adaptation in the pulpal angle was significantly improved by the 5-axis milling machine and lithium disilicate, while the scanner type had no measurable impact.
- The 5-axis milling machine led to more precise fit in the pulpal chamber, with no significant influence from scanner or material.
- Resin composite restorations withstood higher failure loads and survived significantly more loading cycles than lithium disilicate ones, indicating superior fatigue resistance regardless of scanner or milling system.

[Read the Complete Study](#)



Impact of the Superimposition Reference Area on Intraoral Scanning Accuracy in a Partially Dentate Maxilla

Negm et al., 2024,
Queen Mary University of London, UK



Study Background

This study evaluates how different superimposition reference areas (whole region, palate, all teeth) affect the trueness and precision of three intraoral scanners (Primescan, TRIOS 3, and Emerald) in a partially dentate maxilla (Kennedy Class II).

A partially dentate maxillary model was digitized using a validated laboratory scanner (E4, 3Shape, 4 μ m accuracy) as the reference model.

Three Intraoral scanners were tested: Primescan, TRIOS 3, and Emerald (10 scans each).

Superimposition strategies:

1. Whole region of interest (ROI)
2. Palate only
3. All teeth only

Deviations were analyzed in 3D using Geomagic Control X software, with color mapping and Root Mean Square Deviations (RMSD) to quantify errors.

Key Findings

- In the palatal region, Primescan demonstrated the highest accuracy across all superimposition strategies.
- In the bounded edentulous area, Primescan achieved the highest trueness when either the palate or all teeth were used as reference areas. In contrast, Emerald showed the best trueness in this region when the entire region of interest was used as the reference. As for precision, Primescan delivered the most consistent results when aligned using either the whole ROI or the palate.
- In the distal extension area, TRIOS 3 showed the highest trueness regardless of the reference area used, while Primescan delivered the best precision in this region.
- In the dentate region, Emerald showed the highest trueness, particularly when whole ROI or all teeth were used as references, while Primescan provided the greatest precision across all strategies.
- The accuracy of the scans was significantly impacted by the area used for superimposition.

[Read the Complete Study](#)



Effect of splinting scan bodies on the trueness of complete arch digital implant scans with 5 different intraoral scanners

Azevedo et al., 2024,
Complutense University of Madrid, Universidade
Católica Portuguesa, University of Geneva



Study Background

Aim: To evaluate if splinting ISBs or adding landmarks improves full-arch scan accuracy.

To generate a digital reference model, six Straumann tissue-level implants were placed in an edentulous mandible and scanned using a desktop scanner.

Tested intraoral scanners: TRIOS 4, Virtuo Vivo, Medit i700, iTero Element 5D, and Primescan.

Compared scanning techniques:

1. Conventional scanning (without splinting or additional landmarks).
2. Splinted scanning (ISBs were splinted with orthodontic wire and resin).
3. Artificial landmarks (Additional radiopaque ball markers were placed on the mucosa between ISBs).

To determine trueness, all scan datasets were aligned with the reference cast, and deviations were measured through RMS calculations within metrology software.

Key Findings

- The choice of intraoral scanner significantly influenced scan trueness ($P < 0.001$).
- Across all scanning protocols, Primescan outperformed TRIOS 4 in terms of trueness.
- For conventional digital scans, Primescan demonstrated significantly higher trueness compared to TRIOS 4 and iTero 5D, while no significant differences were observed in comparison to Virtuo Vivo and Medit i700.
- For splinted digital scans, Primescan achieved significantly higher trueness than all other tested scanners.
- For artificial landmarks digital scans, no significant differences in trueness were found between Primescan and the other scanners, except for TRIOS 4.
- Primescan consistently achieved the highest numerical trueness, regardless of statistical significance, and its performance was not affected by the scanning technique.

[Read the Complete Study](#)



Evaluation and Comparison of the Accuracy of Three Intraoral Scanners for Replicating a Complete Denture

Le Texier et al., 2024,
Université de Bordeaux, France



Study Background

This study compared the accuracy of three intraoral scanners in reproducing a removable complete denture (RCD).

A maxillary and mandibular RCD were scanned with a desktop scanner (D2000, 3Shape) to create a reference model.

Tested intraoral scanners: Primescan, TRIOS 4 and IS3800.

Each intraoral scanner was used by two experienced operators to capture five scans of the denture models, adhering to a consistent scanning procedure.

Geomagic Control X software was used to compare the scans with the reference model.

Key Findings

- Regardless of whether the scans involved maxillary or mandibular dentures, TRIOS 4 and Primescan demonstrated similar levels of trueness, while the IS3800 showed significantly lower accuracy in this respect.
- In terms of precision, Primescan outperformed the other scanners, while TRIOS 4 and IS3800 showed a similar level of variability, regardless of the denture type.
- Among the scanners evaluated, Primescan resulted in the least amount of distortion along both the anteroposterior and transverse axes for upper and lower dentures. The degree of deformation remained minimal across all measured parameters. In the mandibular scans, TRIOS 4 performed similarly to Primescan from a statistical standpoint.

[Read the Complete Study](#)



Comparison between Conventional and Digital Impressions for Determining Axes and Distances of Three Implants in Straight and Curved Lines: An In Vitro Study

Ben-Izhack et al., 2024,
Tel Aviv University, Israel



Study Background

This study evaluates the accuracy of conventional and digital impressions in capturing implant axes and distances across straight and curved configurations.

To evaluate straight and curved implant arrangements, the researchers used two 3D-printed resin models, each featuring three internal hex implants placed at positions #15–17 and #12–14, respectively.

Polyether impressions and their corresponding type IV gypsum casts were compared against digital scans obtained with the Primescan system.

All impression results were converted into STL files and compared to a reference scan from a laboratory scanner (7 Series Dental Wings) using 3D analysis software.

Key Findings

- Most parameters within each group (straight or curved implant alignments) showed no significant differences between conventional and digital methods. However, when deviations occurred, they were consistently greater in the conventional method, particularly in curved implant lines.
- Conventional impressions had significantly higher errors in curved implant lines compared to straight ones, while digital impressions exhibited increased deviations in some parameters but not consistently across all measurements.
- Curved implant lines had a greater impact on the accuracy of conventional impressions than digital ones, with digital scanning demonstrating more consistency in both configurations.
- While not every parameter reached statistical significance, the overall trend clearly favors digital methods for improved accuracy in complex geometries.

[Read the Complete Study](#)



Comparative Analysis of the Comfort of Children and Adolescents in Digital and Conventional Full-Arch Impression Methods: A Crossover Randomized Trial

Serrano-Velasco et al., 2024,
Universidad San Pablo—CEU & Alfonso X
El Sabio University, Spain



Study Background

This study compares the comfort levels of children and adolescents during digital and conventional full-arch impressions, evaluating two intraoral scanners (Primescan and iTero) against conventional alginate impressions.

51 children and adolescents (mean age 12.35 years) participated.

Each participant underwent three impression methods: conventional alginate, iTero, and Primescan.

Comfort was evaluated using a 100 mm Visual Analog Scale (VAS), adapted for children, measuring perception of breathing, smell-taste, nausea, gag reflex, pain, and overall comfort.

Key Findings

- Primescan provided the highest overall comfort ratings, significantly outperforming both conventional alginate impressions and iTero.
- [Conventional Method vs. Primescan](#): The conventional method performs significantly worse than Primescan in almost all parameters, especially overall perception, breathing, smell-taste, nausea, gag reflex, pain, and overall comfort, with no significant difference in temperature perception.
- [Conventional Method vs. iTero](#): iTero achieves significantly better results than the conventional method in breathing, nausea, gag reflex, and overall comfort, while there are no significant differences in overall perception, smell-taste, pain, and temperature.
- [Primescan vs. iTero](#): Primescan is rated significantly better than iTero in terms of pain and overall comfort, whereas no significant differences were observed between the two digital methods in overall perception, breathing, smell-taste, nausea, gag reflex, or temperature.

[Read the Complete Study](#)



Influence of Scanbody Design and Intraoral Scanner on the Trueness of Complete Arch Implant Digital Impressions: An In Vitro Study

Meneghetti et al., 2023,
Pontifical Catholic University of Rio Grande do Sul, Brazil



Study Background

This study evaluates how different scanbody (SB) designs and intraoral scanners (IOS) influence the trueness of full-arch implant digital impressions.

The study employed a 3D-printed, fully edentulous maxillary model containing six implant analogues to evaluate seven scanbody designs (SB1–SB7) across four intraoral scanners: Primescan, Omnicam, TRIOS 3, and TRIOS 4.

Each scanner and scanbody combination was tested in 10 scans.

A desktop scanner (D2000, 3Shape) served as the reference standard.

Metric assessed: 3D deviation, angular deviation, and linear distance between implants #3 and #14.

Key Findings

- Of all scanners examined, the Primescan system provided the most accurate 3D values in terms of deviation from the reference scan.
- While the linear distance between implants #3 and #14 did not differ significantly across TRIOS 3, TRIOS 4, and Primescan, the Primescan system yielded the smallest numerical deviation.
- Among the scanbodies tested, SB2 and SB7 showed the lowest median 3D deviations, with no statistically significant difference between them.

[Read the Complete Study](#)



Scan accuracy and time efficiency of different implant supported fixed partial denture situations depending on the intraoral scanner and scanned area: An in vitro study

Dönmez et al, 2023,
University of Bern, Switzerland



Study Background

Evaluate the scan accuracy and time efficiency of 2 different intraoral scanners in 3 different fixed partial denture (FPD) situations.

The three test models represented distinct edentulous spans:

- Model 1 simulated a posterior 3-unit gap (implants at right first premolar and first molar).
- Model 2 a posterior 4-unit span (right canine to first molar).
- Model 3 an anterior 4-unit span (implants at the lateral incisor sites).

Reference: Industrial optical scan (ATOS) after scan body placement.

Each model was scanned by Primescan and TRIOS 3; and by complete- and partial-arch- scans.

Values of 3D distance deviation, inter-implant distance deviations and angular deviations were calculated for trueness and precision.

A stopwatch was used to record the cumulative time for scanning, data handling (export/import), and CAD processing up to the point where the design phase could begin.

Key Findings

- Primescan showed significantly better 3D trueness than TRIOS 3 in the anterior 4-unit and posterior 3-unit models, regardless of whether a complete or partial arch scan was performed, while no significant difference between scanners was found in the posterior 4-unit model.
- Primescan showed significantly higher precision than TRIOS 3 in all models when 3D distance deviations were considered.
- Regarding interimplant distance trueness, no significant differences between the scanners were found in any of the models, except for the posterior 3-unit model, where Primescan performed significantly better in complete-arch scans.
- For interimplant distance precision, Primescan performed significantly better than TRIOS 3 in the posterior 3-unit model, regardless of the scanned area.
- For mesiodistal angular deviations, Primescan showed significantly better trueness and precision than TRIOS 3 in the posterior 3-unit model.
- For buccopalatal angular precision, Primescan outperformed TRIOS 3 in the posterior 3-unit model when complete-arch scans were performed, whereas TRIOS 3 showed significantly better results in the posterior 4-unit model during partial-arch scans.
- Across all models and scan regions, Primescan showed significantly higher time efficiency than TRIOS 3.

[Read the Complete Study](#)



Comparison of 3D accuracy of three different digital intraoral scanners in full-arch implant impressions

Akkal et al., 2023,
Atatürk University, Turkey



Study Background

To assess how digital intraoral scanners perform when capturing implant positions, both angled and parallel, in a fully edentulous jaw.

Compared intraoral scanners: Primescan, TRIOS 4, Carestream 3600.

In vitro study using a polyurethane mandibular model with 6 implants placed at various angulations (0°, 5°, 15°).

A 3D reference model was obtained using an optical scanner (ATOS Capsule).

Digital impressions were acquired with each scanner following the manufacturer's protocols.

Distance and angular deviations between scan bodies were measured to assess trueness and precision.

Key Findings

- Primescan demonstrated the highest trueness among the tested scanners, showing the closest match to the reference model in both distance and angular measurements. TRIOS 4 showed moderate accuracy, while Carestream 3600 exhibited the largest deviations. The differences in trueness between the scanners were statistically significant.
- In terms of precision, Primescan showed the lowest variability across repeated scans. However, this difference was not statistically significant.

[Read the Complete Study](#)



Effect of Different Intraoral Scanners and Scanbody Splinting on Accuracy of Scanning Implant-Supported Full Arch Fixed Prosthesis

Ashraf et al., 2023,
Ain Shams University, Cairo, Egypt



Study Background

The study aimed to evaluate the accuracy (trueness and precision) of different intraoral scanners (IOS) in scanning full-arch, implant-supported prostheses.

Two maxillary models were fabricated, each featuring an All-on-4 implant setup.

Two groups were defined based on the angulation of the posterior implants (distally tilted at 30° or 45°).

Each group was further divided based on scanner type: Primescan, TRIOS 4, Medit i600.

Each scanner was tested with two different scanning techniques: Splinted (Scanbodies connected using a modular chain device) and non-splinted (Scanbodies left unconnected).

Key Findings

- Primescan and TRIOS 4 showed comparable trueness values, with both scanners being significantly more accurate than the Medit i600. In terms of precision, only Primescan performed significantly better than Medit, while TRIOS 4 showed no significant difference.
- Splinting the scanbodies using a modular chain significantly improved both trueness and precision, regardless of the scanner used.
- Varying the distal implant angulation between 30° and 45° had no significant effect on either trueness or precision.

[Read the Complete Study](#)



What to Prefer in Patients with Multibracket Appliances? Digital vs. Conventional Full-Arch Impressions—A Reference Aid-Based In Vivo Study

Bock et al, 2023,
Justus Liebig University, Gießen, Germany



Study Background

This clinical study compared the trueness, precision, and required time of full-arch impressions taken with digital intraoral scanners versus conventional alginate impressions in patients with multibracket appliances (MBA).

30 patients with MBA included.

Reference: four precision spheres placed on the occlusal surfaces of lower posterior teeth for accuracy assessment.

Tested intraoral scanners: Primescan, TRIOS 4 wireless POD, Planmeca Emerald S, Medit i700.

Measurement of distances between the center of the steel spheres and of six angles of constructed planes.

Evaluation of accuracy and required time.

Key Findings

- While no consistent statistically significant differences were found between the intraoral scanners, the data suggest that Primescan and TRIOS 4 tended to perform slightly better in terms of accuracy, particularly in comparison to Medit i700. However, single measurements revealed minor advantages of certain devices in specific distances.
- Although all intraoral scanners showed lower overall deviations than the conventional impression technique, the longest measured distance revealed a slightly better result for the conventional method, although this difference was not statistically significant.
- All intraoral scanners showed smaller angular deviations than the conventional impression method. Among the scanners, TRIOS 4 and Emerald S showed slightly better results than Primescan and Medit i700. The conventional method had the highest variation, indicating the lowest precision. However, none of the observed differences reached statistical significance.
- Primescan required significantly less time than all other intraoral scanners. No significant time differences were found among TRIOS 4, Emerald S, and Medit i700.

[Read the Complete Study](#)



User Experience of Intraoral Scanners in Dentistry: Transnational Questionnaire Study

Al-Hassiny et al., 2023,
Institute of Digital Dentistry, Wellington, New Zealand



Study Background

Objective: To assess the practical user experience, satisfaction, and challenges of intraoral scanners (IOS) in dental practice worldwide.

Method: An online survey with 1072 valid responses from dental professionals across 109 countries.

Focus Areas:

- Frequency of IOS use in daily practice.
- Preferred scanner systems and device diversity.
- Satisfaction ratings across various parameters (overall satisfaction, speed, support, accessibility, price).
- Key challenges such as high acquisition costs and inadequate training.

While this study is methodologically robust and scientifically sound, it is important to note that its findings are based on self-reported user experiences rather than objective measurements.

Key Findings

- More than 78% of respondents incorporate intraoral scanners into their daily clinical workflow, but only about 50% use them to scan patients on a daily basis.
- A total of 36 different intraoral scanner systems were reported across the cohort.
- The top three in **overall** satisfaction are Medit i700 Wireless (1st place, 4.77), Medit i700 (2nd place, 4.50), and Dentsply Sirona Primescan (3rd place, 4.49).
- In terms of **speed**, Primescan achieves 2nd place with a score of 4.52, only behind Medit i700 Wireless (4.77).
- While Primescan ranks in the top three for overall satisfaction and second for speed, its lower rankings in **support** (11th), **accessibility** (11th), and **price** (12th) highlight clear areas for further enhancement.

[Read the Complete Study](#)



Predictability of intraoral scanner error for full-arch implant-supported rehabilitation

Zingari et al., 2023,
University of Parma, Italy



Study Background

In-vitro study on the error predictability of three intraoral scanners in fully edentulous jaws with implants.

Objective: Identify predictable Read the Complete Study of errors in scans.

Scanners: Primescan, TRIOS 3, Carestream 3600.

Analysis of trueness and precision in distance and angular measurements.

Measurement via scan body origin points, compared with coordinate-measuring machine reference data.

Key Findings

- Primescan demonstrated significantly higher precision in interdistance measurements compared to both CS3600 and TRIOS, while CS3600 and TRIOS 3 showed no significant difference.
- TRIOS 3 showed significantly lower trueness compared to both Primescan and CS3600, which performed similarly with no significant difference between them.
- All three scanners (Primescan, TRIOS 3 and CS3600) showed comparable precision in axial inclination measurements, with no significant differences observed.
- CS3600 showed significantly lower trueness in axial inclination measurements compared to both Primescan and TRIOS 3, while no significant difference was found between Primescan and TRIOS 3.
- In terms of trueness, both Primescan and TRIOS 3 tended to overestimate axial inclination angles. Primescan showed fewer outliers and a characteristic bimodal distribution, with measurements typically elevated by about 0.4 to 0.6 degrees.

[Read the Complete Study](#)



Effect of intraoral scanner and fixed partial denture situation on the scan accuracy of multiple implants: An in vitro study

Dönmez et al, 2023,
University of Bern, Switzerland



Study Background

Evaluate the scan accuracy of 2 different intraoral scanners in 3 different fixed partial denture (FPD) situations.

The three test models represented distinct edentulous spans:

- Model 1 simulated a posterior 3-unit gap (implants at right first premolar and first molar).
- Model 2 a posterior 4-unit span (right canine to first molar).
- Model 3 an anterior 4-unit span (implants at the lateral incisor sites).

Reference: Industrial optical scan (ATOS) after scan body placement.

Each model was scanned by Primescan and TRIOS 3; and by partial-arch scans.

Values of 3D distance deviation, inter-implant distance deviations and angular deviations were calculated for trueness and precision.

Key Findings

- In terms of 3D distance deviation, Primescan demonstrated significantly greater trueness than TRIOS 3 in Models 1 and 3.
- Regarding 3D distance deviation precision, Primescan outperformed TRIOS 3 across all three models.
- For inter-implant distance deviation, no statistically significant difference was found between Primescan and TRIOS 3 in any of the three models.
- Primescan achieved significantly higher precision than TRIOS 3 in Model 1 for inter-implant distance deviation.
- No statistically significant difference in trueness was observed between Primescan and TRIOS 3 for mesiodistal angular deviation.
- Primescan achieved significantly higher precision than TRIOS 3 for mesiodistal angular deviation in Models 1 and 2.
- For buccopalatal angular deviation, no statistically significant difference in trueness was observed between Primescan and TRIOS 3 in any of the three models.
- Primescan demonstrated significantly higher precision than TRIOS 3 in Models 1 and 3 for buccopalatal angular deviation.

[Read the Complete Study](#)



Comparison of the measurement error of optical impressions obtained with four intraoral and one extra-oral dental scanners of post and core preparations

Dupagne et al, 2023,
Université Paris Cité, Montrouge, France



Study Background

Aim:

- To determine the trueness of scanners when digitizing root canal preparations.
- To investigate the impact of adjacent-tooth situations (presence vs. absence) on the quality of the digital scan.

Two 3D-printed CAD models:

- PAT: with adjacent teeth
- WAT: without adjacent teeth

Tested Scanners: Primescan, Omnicam, Medit i700, TRIOS 4 and E3 tabletop scanner.

Reference scan: micro-CT tomographic scanner.

Calculation of mean absolute distance.

Depth ranges analyzed:

- 0-3 mm
- 3-6 mm
- 6-9 mm

Key Findings

- With adjacent teeth present, Primescan showed significantly lower mean measurement error than all other scanners at 0-3 mm; at 3-6 mm and 6-9 mm it remained superior to Omnicam and E3, with no significant differences vs TRIOS 4 or Medit i700.
- Without adjacent teeth, Primescan shows stable measurement error across depths. Differences vs Medit i700 and Omnicam are not significant, while Primescan is significantly superior to TRIOS 4 at 0-3 mm and to the E3 tabletop scanner at all depths.
- Across scanners, absence of adjacent teeth (WAT) yields significantly lower error at 0-3 mm. Beyond 3 mm, a clear WAT advantage persists only for Omnicam (3-6 mm and 6-9 mm), while Primescan and TRIOS 4 show no significant differences, and Medit i700 shows a small WAT benefit at 3-6 mm.

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Accuracy of four recent intraoral scanners with respect to two different ceramic surfaces

Yatmaz et al, 2023,
Université Paris Cité, Montrouge, France



Study Background

To compare the accuracy of intraoral scanners with respect to different ceramic surfaces.

The study used two complete upper jaw models that had identical dental configurations, but the teeth were made from different materials, each with distinct optical characteristics ([ZR] and [LD]).

[ZR]: zirconia-based teeth model; [LD]: lithium disilicate-based teeth model.

Complete arch scans were done with Omnicam, Primescan, TRIOS 4, Viva Scan.

Reference scan: ATOS scanner.

Assessment of trueness and precision using absolute mean deviation values.

Key Findings

- For the LD model, Primescan, TRIOS 4, and VivaScan all achieved significantly higher trueness than Omnicam, with no significant differences among the three.
- For the LD model, Primescan demonstrated significantly higher precision than all other scanners.
- For the ZR model, Primescan and TRIOS 4 achieved the highest trueness, with no significant difference between them.
- For the ZR model, Primescan achieved the highest precision.
- The type of material (LD or ZR) did not significantly affect trueness for any of the scanners. Material type had a significant effect on precision for Omnicam and VivaScan, but not for Primescan or TRIOS 4.

[Read the Complete Study](#)



Accuracy of 14 intraoral scanners for the All-on-4 treatment concept: a comparative in vitro study

Kaya et al, 2022,
Trakya University, Edirne, Turkey



Study Background

To evaluate the trueness and precision of 14 different intraoral scanners (IOS).

An edentulous maxillary model including 4 dental implants with scan bodies was used as reference.

Reference scan was obtained by using an ATOS scanner.

Intraoral scanning with: Primescan, iTero 2, iTero 5D, Virtuo Vivo, TRIOS 3, TRIOS 4, CS3600, CS3700, Emerald, Emerald S, Medit i500, BenQ BIS-I, Heron IOS, Aadvia IOS 100P.

Superimposition of the scans was done according to best-fit algorithm.

Evaluation of trueness and precision.

Key Findings

- In an All-on-4 edentulous maxilla model, Primescan demonstrated the highest trueness and was statistically indistinguishable from iTero 5D, Virtuo Vivo, TRIOS 3, and TRIOS 4, while this top group achieved significantly more accurate results than the other scanners tested.
- Primescan demonstrated the highest precision, with significantly lower deviation values compared to all other scanners, while iTero 5D, TRIOS 3, TRIOS 4, Medit i500, and Virtuo Vivo constituted a second tier with good but less consistent repeatability, and the remaining devices exhibited substantially greater variability.

[Read the Complete Study](#)



Accuracy of complete-arch implant digital scans: effect of scanning protocol, number of implants and scan body splinting

Denneulin et al, 2022,
Prosthodontics Department, Université de Paris



Study Background

Evaluation of how scanning strategy, implant count, and splinting affect the accuracy of digital scans in a fully edentulous arch.

A mandibular model with six implants was used, and the scan body positions were recorded in 3D using a coordinate measuring machine.

Tested intraoral scanners: TRIOS 3 and Primescan.

Experiment 1: Assessment of how different scanning protocols affect measurement accuracy.

Experiment 2: Comparison of accuracy across three simulated clinical scenarios, varying the number of implants and the span of the scanned arch.

Experiment 3: Assessment of connecting the scan bodies.

Key Findings

- For the effect of the scanning protocol, Primescan showed numerically better trueness values than TRIOS 3, but no statistical comparison between the scanners was performed. For Primescan, using the linear scanning protocol resulted in a statistically significant improvement in distance measurements compared to the zigzag approach, while angular measurements showed no meaningful difference between the two protocols.
- For the effect of the number of implants, Primescan showed numerically better values than TRIOS 3, but no statistical comparison between the scanners was performed. Primescan demonstrated a statistically significant improvement in distance trueness and precision when scanning six implants versus four, whereas angular deviation remained unaffected.
- For the effect of splinting, Primescan showed numerically better values than TRIOS 3, but no statistical comparison between the scanners was performed. In the six-implant configuration, splinting had no significant impact on distance or angular deviation for Primescan, whereas for TRIOS 3, splinting significantly worsened distance trueness and precision, with no effect on angular deviation.
- No statistical comparisons between the scanners were performed in any of the experiments.

[Read the Complete Study](#)



Feasibility of using an intraoral scanner for a complete arch digital scan, part 2: A comparison of scan strategies

Son et al., 2023,
Kyungpook National University, Republic of Korea



Study Background

Comparison between 6 intraoral scanners and 2 lab scanners for complete-arch scans. Focus on how scan strategy affects accuracy, with two strategies tested.

Scan Strategy 1:

- Start: left maxillary second molar → right maxillary second molar (occlusal).
- Then: lingual and buccal surfaces.

Scan Strategy 2:

- First pass: Left maxillary second molar → right maxillary canine (occlusal), then back along lingual and buccal surfaces.
- Second pass (Start b): Left maxillary canine → right maxillary second molar (occlusal), then back along lingual and buccal surfaces.

Scanners evaluated: TRIOS 2, TRIOS 3, CS3500, CS3600, Medit i500, Primescan, DOF, E1.

Accuracy assessed via Root Mean Square (RMS) values of segmented teeth compared to a reference model.

Key Findings

- The study found that scan strategy, the type of intraoral scanner, and the position of the tooth within the arch all had a significant impact on trueness.
- For all intraoral scanners tested, scan strategy 2 resulted in numerically lower overall RMS values compared to scan strategy 1. However, an increase in the clinically acceptable scan range was observed only for TRIOS 3, CS3600, and Medit i500, with the improvement for TRIOS 3 being statistically significant. Primescan maintained a long clinically acceptable range regardless of scan strategy.
- When excluding laboratory scanners and considering only the overall RMS values of the intraoral scanners, Primescan showed the lowest numerical RMS in both scan strategies, with values below the 100 μm clinical acceptability threshold. In SS1, this value (90.2 μm) was statistically similar to that of Medit i500 and CS3600, while for SS2 (81.4 μm) no statistical comparison between scanners was reported.
- Primescan achieved a clinically acceptable scan range of seven consecutive teeth on the starting side (L7 to L1) and three consecutive teeth on the opposite side (R5 to R7).
- For all intraoral scanners tested, accuracy decreased with increasing distance from the scan start, as reflected by higher RMS values toward the opposite side of the arch.
- In both scan strategies, the accuracy of all six intraoral scanners was highest near the scan start and gradually decreased toward the opposite side of the arch.

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Effect of Splinting Scan Bodies on Trueness of Complete Arch Implant Impression using Different Intra-oral Scanners: An in vitro study

Retana et al, 2022,
Louisiana State University School of Dentistry, New Orleans, LA



Study Background

To compare the trueness of full-arch implant impressions obtained with seven intraoral scanners, with and without splinted scan bodies.

A model of a toothless lower jaw containing four implant replicas served as the reference specimen.

Reference: inEos X5 lab scanner.

Tested intraoral scanners: Primescan, Omnicam, TRIOS 4, TRIOS 3, Planmeca Emerald, Medit i500 and Carestream 3600.

Scans were compared to the reference by measuring distances between defined points on the scan bodies in 3D analysis software.

Key Findings

- All tested factors (splinting, implant spacing, and scanner selection) had a measurable impact on trueness, and these influences were interdependent.
- Among the devices assessed, Primescan achieved the highest overall trueness, with only Omnicam performing on a comparable level.
- Using splinted scan bodies generally enhanced accuracy across scanners and implant positions, with the exception of specific cases: Omnicam at AC and Medit at AB and AD.
- Shorter implant spans delivered higher trueness compared to the widest spacing, while performance between the two shorter distances showed no significant difference.

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The transfer accuracy of digital and conventional full-arch impressions influenced by fixed orthodontic appliances: a reference aid-based in vitro study

Schlenz et al, 2022,
Justus Liebig University Giessen, Germany



Study Background

To assess the full-arch scan accuracy of various intraoral scanners and conventional alginate impressions, both in the presence and absence of fixed orthodontic appliances.

Different orthodontic scenarios:

- Group A: Natural teeth
- Group B: Metal brackets without wire
- Group C: Metal brackets with wire
- Group D: Ceramic brackets without wire
- Group E: Ceramic brackets with wire

Reference method with 4 steel spheres reversibly bonded to mandibular teeth was applied.

Impression taking was done with CS 3600, Primescan, Medit i500, TRIOS 4 wireless POD, Planmeca Emerald S and by conventional alginate impression (CAI).

Measurement of distances between the center of the steel spheres and evaluation of accuracy.

Key Findings

- Intraoral scanners demonstrated higher transfer accuracy than conventional alginate impressions in all settings involving fixed orthodontic appliances.
- In the absence of orthodontic appliances, conventional impressions showed the highest accuracy.
- On average, Primescan had the shortest scanning times among the tested intraoral scanners.
- The combined process of alginate impression taking and plaster model fabrication was slower than any of the digital workflows.

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Accuracy of current intraoral scanning systems for full-arch impressions: An in vitro study

Buhl et al., University of Zurich, Switzerland



Study Background

- Aim:
 - Compare accuracy: Assess trueness and precision of IOS for complete-arch scans.
 - Compare metrics: Examine whether three evaluation parameters ((90_10)/2 percentile, 80ABS, meanABS) yield comparable results for easier cross-study comparisons.
- Reference: Two specially fabricated full-arch models (one maxilla and one mandible) designed with different optical surface properties and both scanned using a high-precision industrial system (ATOS III, Triple Scan MV60).
- Tested IOS: Aoralscan 3, Emerald Green, iTero 5D, Medit i900, Primescan, Primescan 2, and TRIOS 5.
- Metric assessed: trueness and precision calculated via (90_10)/2 percentile, 80ABS and meanABS.

Key Findings

- Conventional impressions (CONV) achieved significantly the best results in both trueness and precision compared to all other systems, yet all intraoral scanners remained below the 100 µm threshold for both parameters.
- Primescan (PS) performed significantly better than all other intraoral scanners in both parameters.
- Primescan 2 (PS2) ranked directly after Primescan: significantly better than all other intraoral scanners except Primescan; in trueness, no significant difference compared to Aoralscan 3 (SHI).
- The three evaluated metrics, (90_10)/2 percentile, 80ABS, and meanABS, showed a very high correlation with each other, indicating their interchangeability for assessing accuracy.

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Clinical study on the accuracy of wireless intraoral scanners for digital full arch impressions of dentate arches

MA Schlenz et al., 2025,
University of Kiel, Germany



Study Background

- An in-vivo comparison of four wireless intraoral scanners, one wired scanner, and a conventional impression in terms of trueness and precision.
- Tested IOS: Dexis IS 3800W, Medit i700W, Primescan 2, TRIOS 5, and Primescan AC.
- Metallic reference aid with four 5 mm steel spheres measured ten times with a coordinate measuring machine (CMM).
- The conventional stone cast was measured with a coordinate measuring machine (CMM) and compared to the same reference model.
- IOS scans were analyzed in GOM Inspect and compared to the CMM-derived reference dataset.
- Trueness and precision were calculated based on linear distances between the sphere centers compared to the reference dataset.

Key Findings

- Significant differences ($p < 0.05$) in trueness and precision were found across the five IOS and the conventional impression (CVI).
- On pooled distances, Primescan 2 and Primescan AC showed no statistically significant differences compared with the CVI, while Dexis IS 3800W and Medit i700w showed significantly larger deviations.
- For the short linear distance near the scan origin (D1_2), Primescan 2 showed significantly smaller trueness deviation than CVI.
- Scan accuracy was significantly distance-dependent ($p < 0.05$), showing smaller errors at short distances and larger deviations across longer or diagonal spans.

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