

SCAN MORE. SCAN BETTER.

Dickerman Dental Prosthetics Presents:

A Comprehensive Guide for Clinical IOS Excellence

1st Edition

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How to Use This Guide

This guide is designed to be useful whether you are scanning your first case or refining an established digital workflow. Use the sections below based on what you need today.

If you are brand new to intraoral scanning

- Read the Introduction and Fundamentals first to understand the 'why' behind common scanning errors.
- Start with the Pre-Scan Setup and general accuracy tips before attempting full-arch or implant cases.
- On your first few cases, prioritize clean data capture over speed. Speed comes naturally as your scan path becomes consistent.
- Use the troubleshooting chapter as a checklist when something looks wrong on screen.

If you already scan regularly

- Jump directly to the Evidence-Based Scanning Strategies and the Step-by-Step Clinical Protocols for case-specific optimization.
- Use the Quality Assurance and Maintenance sections to reduce remakes and rescans.
- Use the Implementation and Training sections to standardize your team and reduce variability between operators.



Use this printable, step-by-step checklist to produce a clean, clinically usable scan even if you have never scanned before. Check each box as you go. Where evidence-based or manufacturer-supported guidance applies, supporting citations are included.

A. Device readiness and operatory setup

- ☐ Power on the scanner hub/base and the computer/workstation.
- ☐ Launch the scanning software and confirm the system status shows Ready.
- ☐ Confirm battery charge (wireless) or cable connection (wired).
- ☐ Inspect the scanning window for scratches, debris, or fogging; clean per manufacturer IFU (14).
- ☐ Allow the scanner tip to reach operating temperature (warm tip reduces unclear images) (14).
- ☐ If calibration is prompted, complete it per manufacturer instructions (TRIOS 5 is calibration-free) (5)(14).
- ☐ Dim or turn off the overhead operatory light to reduce optical interference during scanning (14).

B. Infection control and barriers

- ☐ Perform hand hygiene and don appropriate PPE per your clinic protocol.
- ☐ Install a new manufacturer-approved barrier/sleeve on the scanner tip (6).
- ☐ Confirm all scanners and accessories are disinfected following your jurisdictional requirements and the manufacturer's IFU (general disclaimer; IFUs take precedence).
- ☐ Prepare any required calibration target and ensure it is clean and ready (14).
- Clinician Tip: Ensure that all scanner and equipment is properly disinfected following both state and manufacturer IFUs and regulations.

C. Patient preparation and moisture control

- ☐ Explain what the patient will feel and how long scanning typically takes (set expectations).
- ☐ Place cheek retractors; position cotton rolls or 2x2 sponges to control saliva as needed (15).
- ☐ Ask the patient to relax the tongue; use a mirror/retractor as needed for lingual access.
- ☐ Dry the teeth and gingiva with air and high-volume suction immediately before scanning (13).
- ☐ If scanning a crown prep, confirm the finish line is visible; if you cannot see it, you cannot scan it (20).

1. Introduction

Digital dentistry is transforming how clinicians capture tooth and soft-tissue anatomy. Intraoral scanning (IOS) removes the discomfort of conventional impression materials and provides highly precise digital models. However, the number of scanners, scanning strategies and workflows can be overwhelming for a new user. This guide unifies evidence-based information from peer-reviewed research and manufacturer specifications with step-by-step protocols to help dental professionals choose the right scanner and perform accurate scans across a variety of clinical situations. Each factual claim is referenced with a numbered footnote; see the References section at the end for full details.

Key Takeaway: By following the protocols and strategies in this guide, you can reduce your scanning time from 20+ minutes on your first case to under 15 minutes by your tenth case, while simultaneously improving accuracy and consistency (1)(2).



2. Fundamentals of Intraoral Scanning

2.1 How IOS Works

Modern scanners project a pattern of structured light or laser onto the oral tissues and record the reflected images with high-resolution cameras. Software stitches the images together into a 3-D mesh. There are three main technologies:

Structured-light and confocal scanners

Most IOS devices use structured-light patterns coupled with confocal imaging to capture surfaces at multiple focal depths. This approach produces highly accurate models but may require specific scanning strategies to minimize stitching errors.

Photogrammetry

This technique is used for full-arch implant cases and relies on multiple cameras to triangulate the position of implant scan bodies. A 2025 in vitro study comparing conventional impressions, intraoral scanners and two photogrammetry systems found median trueness deviations of 66 μm for conventional impressions, 78 μm for intraoral scanning and 25-28 μm for photogrammetry; photogrammetry achieved the highest accuracy while intraoral scanning was least accurate (3).

Hybrid systems

Newer devices combine intraoral scanning and photogrammetry in a single handpiece to improve implant accuracy. This integration is discussed in the scanner selection section.

2.2 Advantages and Limitations

- Improved patient comfort.
- Elimination of impression material distortion.
- Immediate digital models.
- Faster communication with dental laboratories.
- Faster integration with CAD/CAM workflows.
- Documented 40% fewer crown remakes due to margin issues (4).
- 33% fewer remakes caused by fit problems (4).
- For full-arch implants, a 2025 in vitro study found photogrammetry achieved higher accuracy than conventional impressions and intraoral scanning (3).
- Clinicians should therefore select their technology based on case type and consider photogrammetry when scanning multiple implants.





3. Choosing the Right Scanner

Selecting an IOS system depends on clinical focus, integration requirements and budget. This section summarizes key characteristics of leading scanners based on official manufacturer data and credible releases. Use this as a starting point when evaluating equipment.

3.1 Scanner snapshot

3Shape TRIOS 5 — Calibration-free design and built-in ScanAssist engine for intelligent alignment (5). Measures 3.8 x 3.7 x 26.6 cm and weighs 299 g including battery (5). Standard field of view; batteries swap quickly; up to 66 minutes scanning per battery (5). Best fit: Single crowns and general restorative workflows; strong margin capture and low maintenance.

Dentsply Sirona Primescan 2 — Cloud-native platform with DS Core; full-arch scans can be captured in under one minute (6). Handpiece weight approx. 300 g; wireless; single-use or sterilizable sleeves (6). Designed to scan the entire arch rapidly; manufacturer emphasizes cloud workflow and hardware independence (6). Best fit: Busy practices prioritizing cloud workflow and rapid full-arch scanning.

Align iTero Lumina — Multi-Direct Capture technology with a field of view about 3x larger than previous models and capture depth up to 25 mm (7)(8). Wand is approximately 50% smaller and 45% lighter than earlier iTero scanners (7). Large field of view and up to 25 mm capture depth (7)(8). Best fit: Orthodontics and clear aligners; also restorative workflows after restorative capability updates (8).

Medit i900 classic — Third-generation optics; scan depth up to 30 mm; photo-realistic color rendering (manufacturer specifications). Ultra-light handpiece: 165 g including the tip (manufacturer specifications). Scan depth up to 30 mm with a wide field of view (manufacturer specifications). Best fit: Balanced general restorative and orthodontic use at mid-range pricing (manufacturer positioning).

Shining3D Aoralscan Elite — Hybrid device combining intraoral scanning with photogrammetry in one system (9). Handpiece weight 124 g (without cable) (9). Manufacturer-reported scan depth 22 mm (9). Best fit: Practices doing implant work that want a hybrid intraoral scanning + photogrammetry workflow (3)(9).

3.2 Key takeaways for selection

Accuracy vs span: while most scanners perform well for single crowns, longer spans magnify cumulative errors. Hybrid scanning/photogrammetry workflows can improve accuracy for multiple implants (3)(9).

Ergonomics: extended scanning sessions with heavier devices are associated with increased muscle activation and fatigue in the arm, neck, and shoulder muscles (10).

Field of view/depth: deeper capture can help with deep palates or edentulous regions; iTero Lumina reports up to 25 mm capture depth (7)(8).

Workflow integration: consider whether cloud storage/hardware independence (Primescan 2 and DS Core) (6) or aligner-centric integrations (iTero) are critical for your practice.



4. Evidence-Based Scanning Strategies

4.1 The OWBP protocol

The scanning path influences both trueness and precision. A recent pilot study evaluated several scanning patterns—zig-zag, straight, oblique back-and-forth (OBP) and an overlapping wave buccal-palatal (OWBP) technique. The authors reported that the OWBP protocol achieved the highest trueness (mean deviation 1-24 μm) and that scanning shorter segments increased precision (11). Therefore we recommend this method for full-arch scans.

- Start at the occlusal surface of the most distal molar and move anteriorly in a gentle S-shaped motion to ensure overlap of scanned areas.
- Capture the buccal surfaces in one continuous pass, then rotate the scanner to image the lingual surfaces.
- Overlap the passes at the cusp tips to improve stitching accuracy.
- Finish with the palatal surfaces and inspect the scan for holes or artifacts. Rescan deficient areas as needed.

Clinician Tip: The S-shaped motion. The overlapping wave buccal-palatal (OWBP) pattern is reported to achieve very high accuracy in a pilot study. The gentle S-shape increases frame overlap, supporting more reliable stitching (11).

4.2 General tips to improve accuracy

- Shorter spans are more precise. Segment longer arches into two or three sections, especially in heavy saliva or limited access cases (11).
- Restricted mouth opening (below 33 mm) can reduce precision with some scanner designs; plan to segment and slow down when access is limited (12).
- Maintain the manufacturer-recommended scanner distance from the tooth (often about 1-2 cm). Too far can reduce detail; too close can create glare/reflection artifacts (13).
- Move smoothly and avoid abrupt changes in direction. Sudden movements can create ghost images and stitching failures that require rescanning (14).
- Use dry-field isolation. Moisture and reflective surfaces degrade image quality; drier surfaces produce significantly better trueness and precision (13).
- Keep the tip warm. Allow the scanner to reach operating temperature before scanning; a cold tip can produce unclear images (14).



5. Step-by-Step Clinical Protocols

5.1 Pre-scan setup (all cases)

Power up and software check

- Turn on the scanner base/hub and computer.
- Open the scanning software and confirm it displays "Ready". Check battery charge or cable connection.

Calibration and hygiene

- Perform calibration if prompted. TRIOS 5 is calibration-free (5); other systems require periodic calibration.
- Install a new sterile sleeve or barrier (6).
- Prepare the calibration target (if required) and follow on-screen steps (14).
- Ensure all scanner and equipment are disinfected per your jurisdiction and manufacturer IFUs (see General Disclaimer).

Prepare the patient and environment

- Explain the scanning procedure and expected duration.
- Place cheek retractors and cotton rolls or sponges; ask the patient to rest their tongue (15).
- Dry the field with air and high-volume suction (13).
- Dim or turn off overhead operatory lights to reduce scanner interference (14).
- Seat yourself ergonomically and grip the scanner like a pen, not a handpiece (10).

5.2 Single-crown scanning

Scan sequence

- Occlusal pass: start on the occlusal surfaces of the prepared tooth and adjacent teeth; move slowly to capture margins.
- Buccal pass: tilt the scanner to image the buccal surfaces while maintaining overlap with the occlusal data.
- Lingual/palatal pass: rotate and capture the lingual surfaces; use a mirror or retractor to control the tongue.

Margin confirmation

Inspect the digital model. If the margin is unclear, lightly dry the area and rescan with a slower sweep to ensure crisp detail. Watch the greyscale (monochromatic) image, not just the color image, to confirm margin capture (15). The color image can appear to 'see through' saliva, but the greyscale image (which becomes your case file) cannot.

Opposing arch and bite

- Scan the opposing arch using the same steady pattern.
- Capture buccal bite data with the patient in natural occlusion. Scan enough buccal surfaces (often 3-4 opposing teeth) for stable alignment (14).

5.3 Full-arch scanning (OWBP technique)

Scan sequence

- Occlusal wave: begin at the distal molar on one side and move in a sweeping S-shaped path along the occlusal surfaces to the opposite side.
- Buccal wave: return along the buccal surfaces in the same S-shaped motion, ensuring overlap with the occlusal data.
- Lingual wave: move to the lingual surfaces with the same overlapping path.
- Palatal completion: in the maxilla, finish with palatal surfaces; in the mandible, ensure sublingual areas are captured.

If the software struggles or loses tracking, complete each quadrant separately and stitch them using alignment markers. Research indicates shorter spans can improve precision (11).

Quick Tip: Image count. Stay within roughly 2000-2500 images per full-jaw scan. Excess images (above 5000) can cause post-processing failures and waste time (16). Fewer, well-planned images typically produce faster, more stable results.

5.4 Implant and edentulous scanning

Setup and landmarks

- Attach manufacturer-specific scan bodies to implants and confirm full seating per IFU.
- For edentulous ridges, place radiopaque or colored markers to provide landmarks for stitching (17).

When to consider photogrammetry or hybrid workflows

When scanning more than four implants, consider photogrammetry or a hybrid device. A 2025 in vitro comparison reported higher implant-position accuracy for photogrammetry than for intraoral scanning (3). Hybrid systems that integrate photogrammetry can improve multi-implant accuracy compared with conventional IOS alone (9).

Scan sequence

- Begin with the occlusal plane, capturing each scan body's geometry.
- Circle each scan body from multiple angles to ensure complete data capture.
- Scan soft tissue and record mucosal margins.
- Verify capture using the software's inspection tools (e.g., measure inter-implant distances and compare to expected values).

For multiple implants, consider splinting scan bodies with a rigid material at least 4 mm away from the ridge to prevent movement and improve accuracy (17).

5.5 Orthodontic scanning and bite registration

- Broad field capture: scanners with a large field of view (such as iTero Lumina) can speed full-arch capture (7).
- Occlusal surface: start with the occlusal pass and move steadily to avoid gaps.
- Palatal/lingual surfaces: ask the patient to slightly lift the tongue; capture the palatal vault fully.
- Buccal bite: have the patient bite; scan buccal surfaces of both arches simultaneously to record occlusion.
- Post-scan analysis: verify gingival margins and contact points are clearly visible; rescan if necessary.

6. Quality Assurance and Maintenance

Review scans before sending. Zoom into margins, interproximal areas and subgingival regions. Use the software's color maps to identify missing data. Watch for ghost images—double exposures that indicate too-fast scanning motions (14). Manage infection control. Use manufacturer-approved barrier sleeves and disinfectants. Primescan 2 offers single-use sleeves or an optional multi-use stainless sleeve (6). Calibration and updates. Follow each manufacturer's maintenance schedule. TRIOS 5 requires no regular calibration (5), while other systems may prompt calibration after a set number of scans or every 7-14 days. Data backup and storage. Cloud-native systems like Primescan 2 automatically store scans on DS Core (6). For local storage, maintain regular backups to secure servers.

Manufacturer-recommended calibration intervals (15)

Medit — Every 7 days (14 days acceptable if low usage).

iTero — Auto-calibrates; no manual calibration needed.

TRIOS 5 — Calibration-free for the lifetime of the device

TRIOS 4 — Every 7 days (more often with high usage).

Dentsply Sirona — At least once monthly.

7. Implementation and Workflow Integration

7.1 Return on investment (ROI)

Digital impressions save on material costs and reduce chair time. When calculating ROI, include: Initial investment (scanner cost and any required subscriptions), training time (dedicated sessions to train clinicians and assistants—clinicians reach proficiency between 11-15 repeat scans) (2)(18), laboratory costs (many labs offer lower fees for digital models; digital models reduce shipping and turnaround time), and marketing benefits (show patients their own 3-D models to improve case acceptance). Clinical benefits: Documented 27% fewer complaints about high occlusion when using digital workflows (4).

7.2 Financing and leasing

Many manufacturers offer financing plans; weigh monthly payments against the revenue generated by additional same-day procedures. Leases may allow regular upgrades to newer models.

7.3 Team training and delegation

- Appoint a scanning champion. One assistant or hygienist should master the system and train others.
- Use manufacturer tutorials. Each scanner comes with video tutorials and online courses.
- Simulate scanning on typodonts. Practice scanning typodont models to develop muscle memory before scanning patients. Allow at least 10-15 practice scans to reach competency (2)(18). Avoid simultaneous heavy use and new

training. If your practice is scanning heavily (20+ cases per day), defer intensive training on new systems to slower weeks (10).

7.4 Integrating with CAD/CAM and CBCT

File formats. Ensure the IOS exports open formats (STL, PLY) compatible with your CAD software. CBCT alignment. For implant planning, merge the IOS surface model with CBCT data. Many planning software systems automate this process. Digital dentures and print workflows. Scanned edentulous arches can be aligned with functional impressions or occlusal rims to design digital dentures.

8. Emerging Trends and Advanced Considerations

Digital dentistry evolves rapidly. The trends below can inform your scanner selection and long-term workflow planning.

Artificial intelligence: modern software uses AI to identify tooth types, propose margins, and assist with automatic alignment (e.g., TRIOS 5 ScanAssist) (5)

Cloud collaboration: cloud-native systems can support faster sharing with laboratories and specialists (e.g., Primescan 2 with DS Core) (6).

Hybrid and photogrammetry integration: devices that integrate photogrammetry can improve accuracy for multi-implant workflows (9).

Extended field of view and deeper capture: larger FOV and deeper capture can expand scanning into deep palates and edentulous regions (7)(8)

9. Transitioning from Traditional Impressions to IOS

9.1 The mental shift

Recognize the tactile difference: with IOS you will not 'feel' impression material flowing; instead, rely on the live 3-D display (14).

Eyes on the screen: many new users scan more smoothly when they focus on the monitor rather than the handpiece position (14).

Watch the greyscale/monochrome view to confirm margins and critical anatomy (15).

Plan for the digital workflow: decide whether you will use a cloud platform (e.g., DS Core) (6) or export open files (STL/PLY).

Manage the scanning environment: unlike traditional impressions, IOS accuracy is highly dependent on a dry, clear field; evidence supports significantly better accuracy in drier conditions (13).

9.2 Re-learn retraction techniques

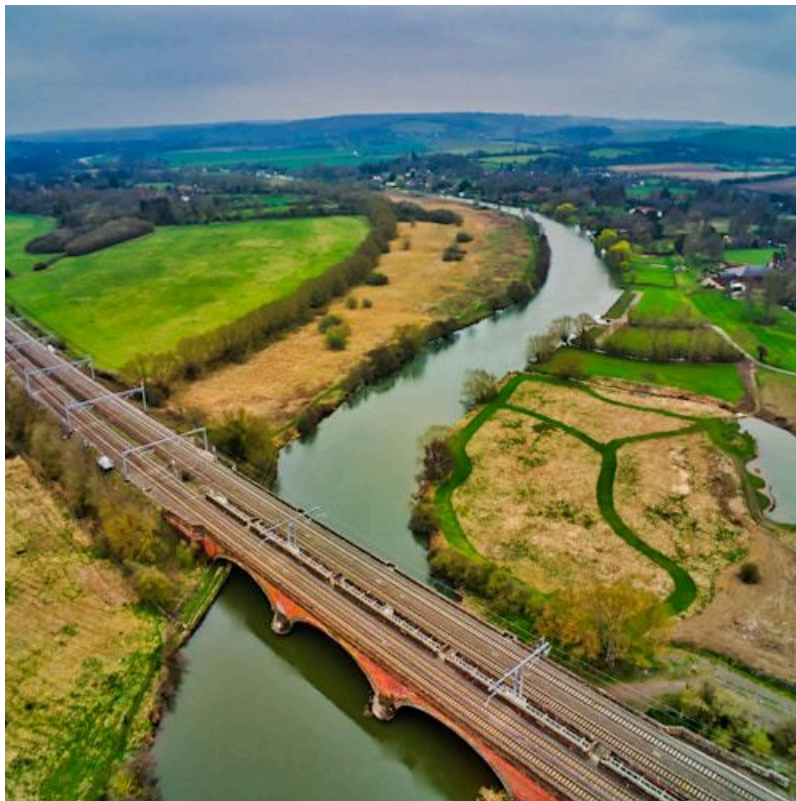
Use double-cord techniques or retraction paste to expose margins effectively (14).

For crown preparations, a two-cord approach can improve sulcus exposure; remove the top cord just before scanning to reveal a clean sulcus (14).

Practice mirror control or use an assistant to retract cheeks and tongue consistently.

9.3 Time expectations during transition

Be patient with your learning curve. Clinical studies report predictable improvements with repeated scans (2)(18): First scan: 20-25 minutes (including setup). Sixth scan: approximately 16 minutes (improvement becomes obvious). Tenth scan: 13-16 minutes (approaching experienced-user speeds). Fifteenth scan and beyond: 12-15 minutes (plateau phase). Time savings are real, but they require deliberate practice and consistent adherence to scanning protocols (2)(18).



10. Practice & Training Strategies to Accelerate Mastery

10.1 Structured practice plan

Week 1-2: Foundation on typodonts

Spend 2-3 hours scanning dentoform models before scanning patients. Focus on smooth motion, consistent overlap, and the OWBP technique for full arches (11). Build hand-eye coordination by watching the software display rather than looking directly into the mouth (14).

Week 2-3: Supervised patient scans

Begin with simple single-crown cases under supervision. Complete 5-10 single-crown scans before moving to full-arch cases. Have a mentor or scanning champion review each scan and provide feedback.

Week 3-4: Confidence building

Scan 5-10 full-arch cases. Practice implant scanning on models before scanning implant patients. Integrate bite registration consistently to build reliable routine.

10.2 Manufacturer training and resources

Follow manufacturer training and support guidance. For example, 3Shape guidance emphasizes: checking the scanning window for scratches, warming the tip, drying teeth, retracting soft tissues, avoiding the dental lamp, and maintaining smooth scanning to avoid ghost images (14).

10.3 Simulate clinical scenarios

- Deep palatal vaults (practice capturing full palatal anatomy; deeper capture can help in these cases) (7)(8).
- Edentulous ridges and digital dentures (use landmarks/markers to support stitching) (17).
- Implant models with multiple scan bodies (practice multi-angle capture and verification) (3)(17).
- Limited mouth opening (practice segmenting and slowing down; restricted opening can reduce precision with some designs) (12).

10.4 Use slow, deliberate motions

Overly fast movements can create ghost images and stitching errors. If a ghost image appears, trim the area and resume scanning from a previously captured region (14). A useful speed target: move the scanner tip roughly as fast as you would move a pen while writing.

10.5 Involve your team

Assign a scanning champion who can mentor others. Encourage cross-training so assistants, hygienists, and dentists are comfortable with hardware and software. Practices with distributed scanning skills maintain more consistent quality and recover faster from staff absences.

11. Real-World Tips & Tricks

11.1 Pro tips from experienced users

- Eyes on the screen, not the mouth: watch the monitor to see missing areas and adjust motion in real time (14).
- Keep the scanner tip clean and warm: check the front glass for scratches or water stains and wait for operating temperature (14).
- Turn off operatory lights: overhead lighting can interfere with optical scanning; dim or switch off the dental lamp (14).
- Dry, dry, dry: saliva pooling distorts scans. Dry teeth thoroughly before scanning and rescan any areas distorted by saliva (14).
- Use two retraction cords for crown preps: a double-cord technique exposes margins better than a single cord. Remove the top cord just before scanning (14).
- Wait for the 'snap' in bite registration: if auto-alignment fails, use manual one- or three-point alignment (14).
- Implant scans: lock surfaces where needed to prevent tissue collapse around scan bodies (14).
- Avoid lifting the scanner away from teeth: delete ghost areas with the trim tool and resume from a stable region (14).

11.2 Moisture management tricks

- Use anchors and landmarks: in challenging edentulous cases, place small reference markers to aid stitching (17).
- Keep tissue dry with positioning: place cotton rolls in lingual vestibules for mandibular scans and along buccal mucosa to absorb moisture (4).
- Consider a dry-field system: isolation systems such as Isodry®, ReLeaf™, or Mr. Thirsty™ can improve scan quality in high-salivation patients (15).

11.3 Handpiece grip and ergonomics

- Hold like a pen, not a handpiece: use a light pinch grip to reduce fatigue (10).
- Support your forearm: rest forearms on an armrest or the chair when possible to reduce neck and shoulder strain (10).
- Take breaks: consider 5-10 minute breaks between patients when scanning multiple cases (10).

12. Common Problems, Causes and Fixes

Unclear margins / missing data — Possible cause: Scanner tip too far or moving too quickly; moisture on tooth surfaces.

Fix: Hold the scanner 1-2 cm from the tooth; dry and retract tissue; rescan the area at a slower pace. Always watch the greyscale image, not just the color image (15).

Holes in the scan — Possible cause: Scanner fails to capture full tooth anatomy; insufficient time on each tooth.

Fix: Stay on the tooth long enough for full capture; check each quadrant for complete coverage before moving on (4).

Missing gingiva — Possible cause: Insufficient tissue rotation.

Fix: Rotate the scanner to capture full gingival region; ensure 3-5 mm of gingiva is scanned before moving to next quadrant (4).

Excess material / auto-generated surfaces — Possible cause: Not enough tooth surface captured; software compensating.

Fix: Stay on tooth surfaces longer; ensure full anatomy capture; trim excess tissue in post-processing (4).

Distorted bite registration — Possible cause: Patient not fully occluding; scanned too much buccal tissue.

Fix: Instruct patient to bite firmly and stay still; focus on the buccal surfaces of teeth in contact rather than soft tissue; capture at least 3-4 opposing teeth (14).

Glare or reflection artefacts — Possible cause: Wet surfaces or metallic restorations.

Fix: Ensure a dry field; apply scanning spray if recommended; adjust angle to reduce direct reflection. For metallic implant bodies, ensure good visibility and consider using scan bodies instead of direct implant scanning (24).

Ghost images — Possible cause: Scanner lifted too far from tooth; scanning too quickly over the same area.

Fix: Delete the ghost area with the trim tool; restart scanning from the previously captured region; slow down (14).

Misalignment in bite scan — Possible cause: Not in natural occlusion; cheeks/tongue interference.

Fix: Instruct on bite position; maintain stable jaw position; capture additional buccal data; inspect 3D model from buccal view (4).

Long processing time / upload fails — Possible cause: Large file size; weak internet; too many images.

Fix: Trim unnecessary areas; target 2000-2500 images per scan; ensure stable connection; re-submit (16).

Handpiece overheating or shutdown — Possible cause: Continuous use; blocked vents.

Fix: Allow device to cool; clean vents; keep backup handpieces; follow duty-cycle recommendations (10).

Poor scan quality in limited mouth opening — Possible cause: Restricted access to posterior areas.

Fix: Use smaller tips and wider FOV (Trios 5 showed better performance with restricted opening than some competitors) (12); segment into quadrants; allow more time per quadrant (12).

Saliva interference — Possible cause: Pooled saliva in preparation or margins.

Fix: Apply drying agent; use HVE; place cotton rolls strategically; blow-dry tooth surface before scanning—studies confirm this significantly improves accuracy (13).

13. Understanding the Learning Curve

13.1 What research shows

Clinical studies consistently show that scan times improve rapidly with repetition, and then plateau as clinicians optimize efficiency (2)(18). Expect the biggest time improvements during the first 10-15 scans. First scan: often 20-25 minutes including setup; tenth scan: typically 13-16 minutes; plateau commonly stabilizes around 12-15 minutes for full-arch cases (2)(18). Some studies report a small increase around the sixth scan after initial improvements; this can reflect experimentation with technique before speed stabilizes (2). Early on, prioritize clean margins, full occlusal coverage, and stable bite registration to prevent remakes (4)(15).

13.2 Device-specific learning curves

Different scanner technologies can have different learning curves. One study reported: TRIOS 4/5 — ~205 seconds first scan, ~133 seconds tenth, plateau by 11th; Dentsply Primescan — ~290 seconds first, ~147 seconds tenth, plateau by 14th (18). In that study, TRIOS devices reached proficiency faster, associated with UI factors and alignment support (18).

13.3 Wired vs. wireless learning curves

Research suggests wired intraoral scanners can have slightly shorter initial learning curves, while wireless devices catch up after about 34 repeated uses (1). Wired setups may feel simpler early on (no battery management, fewer variables), while wireless setups require adaptation to weight balance and battery/sleeve routines. Over time, technique standardization closes the gap, and wireless mobility can become an advantage in multi-chair or high-volume workflows

14. Ergonomics and Operator Health

14.1 Why ergonomics matter

Intraoral scanning is a repetitive-motion task that places sustained demands on the arm, neck, and shoulder muscles. Unlike traditional handpiece work, scanning often requires sustained wand positioning and continuous fine motor control. Research reports significant muscle fatigue during extended scanning sessions (10).

14.2 Key ergonomic principles

- Device weight impacts fatigue: differences between 165 g and 328 g are associated with measurably different muscle activation (10).
- Weight categories: lightweight (165-200 g) includes Medit i900 and Aoralscan Elite; mid-range (299-300 g) includes TRIOS 5 and Primescan 2.
- Proper grip reduces strain: hold the scanner like a pen with a light, relaxed grip (10).
- Postural support is essential: support elbows and sit with a straight back (10).
- Take regular breaks: a 5-10 minute rest every 3-4 scans can reduce cumulative fatigue (10).

14.3 Preventing musculoskeletal disorders

- Vary tasks to allow muscle recovery.
- Strengthen neck, shoulder, and core muscles.
- Maintain proper posture; avoid slouching.
- Choose ergonomic equipment and supportive seating.
- Listen to your body and modify technique or scheduling promptly if pain develops.



15. Quick Reference Checklists

15.1 Pre-scan setup checklist (all cases)

☐ Power up: turn on scanner base/hub and computer.

☐ Software ready: open scanning software and confirm Ready; verify battery charge or cable connection.

☐ Calibration: perform calibration if prompted (TRIOS 5 is calibration-free) (5)(14).

☐ Hygiene: install a new barrier/sleeve; follow manufacturer infection-control guidance (6).

☐ Patient: explain the procedure and expected duration.

☐ Retraction: place cheek retractors; position cotton rolls/sponges for moisture control (15).

☐ Dry field: dry teeth and gingiva with air/HVE immediately before scanning (13).

☐ Lighting: dim/turn off overhead operatory light to reduce interference (14).

☐ Ergonomics: sit upright; support arms; hold scanner like a pen (10).

15.2 During-scan procedures

Single crown and small restorations

- [] Occlusal pass: start on the prepared tooth and adjacent teeth; sweep slowly.
- [] Buccal and lingual passes: tilt for buccal; rotate for lingual/palatal; maintain overlap.
- [] Margins and contacts: inspect the model; re-dry and rescan unclear areas; confirm on greyscale view (15).
- [] Opposing arch: scan opposing teeth using the same pattern.
- [] Buccal bite: capture bite with patient in occlusion; scan enough buccal surfaces for stable alignment (14).

Full-arch and bridge cases (OWBP technique)

- [] Occlusal wave: begin at distal molar; move in S-shaped path across occlusal surfaces (11).
- [] Buccal and lingual waves: return along buccal surfaces; repeat on lingual/palatal surfaces; overlap at cusp tips (11).
- [] Segment if needed: break into quadrants if software loses tracking (11).
- [] Rescan any holes: ensure even coverage before completing.

Implants and scan bodies

- [] Confirm scan body seating per IFU.
- [] Capture scan bodies from multiple angles (circle each scan body).
- [] Include surrounding soft tissue and mucosal margins.
- [] For multi-implant full-arch, consider photogrammetry/hybrid workflows (3)(9).
- [] Verify: use inspection tools and measure distances if available (17).

Orthodontics and bite registration

- [] Broad field capture: use large FOV when available for rapid full-arch scanning (7).
- [] Avoid stopping mid-arch: keep motion continuous to reduce stitching errors (14).
- [] Palatal/lingual surfaces: ask patient to lift tongue; capture palatal vault thoroughly.
- [] Buccal bite: have patient bite; capture buccal surfaces of both arches simultaneously.

Edentulous ridges and digital dentures

- [] Place reference markers/landmarks to support stitching (17).
- [] Scan path: start on ridge crest; sweep posterior to anterior.
- [] Capture flanges: rotate scanner to scan buccal and lingual/palatal flanges.
- [] Verify tissue capture: ensure vestibular depth and frenal attachments are fully captured.

Post-scan tasks

- [] Evaluate the scan: rotate 3-D model; check margins, contacts, and soft-tissue detail (15).
- [] Use color maps: identify incomplete areas; rescan as necessary (14).
- [] Trim and label: remove excess soft tissue/artifacts; add case information (16).
- [] Export and backup: export STL/PLY or submit via cloud workflow; confirm upload completion (6).
- [] Disinfect and maintain: remove barriers; clean handpiece; recharge batteries; follow IFUs (6).

Conclusion

Intraoral scanning streamlines restorative, orthodontic, and implant workflows while improving patient experience. The learning curve is real but predictable; studies suggest many clinicians reach proficiency after repeated scans, with meaningful improvements within the first 10-15 cases (2)(18). To accelerate success in your practice, focus on selecting the right scanner for your clinical focus, mastering the OWBP scanning strategy for full-arch cases (11), prioritizing dry-field isolation and patient positioning (13), practicing on models before patient cases (2)(18), respecting ergonomic principles to prevent repetitive strain injury (10), and building a skilled team with distributed scanning competency. When used thoughtfully and systematically, intraoral scanning technology can enhance clinical outcomes, reduce laboratory remakes, and strengthen your digital workflow.



16. References and Source Links

16.1 Numbered references

1. Comparison of the learning curve of intraoral scanning with two different intraoral scanning devices. Semmelweis University (2023). Scanning times for TRIOS 4 (205s first, 133.6s fifteenth) and Primescan (289.8s first, 147s fifteenth) demonstrate device-specific learning curves with plateau by 11th-14th scan.
2. Learning curve of digital intraoral scanning - an in vivo study. NIH (2020). Ten dental students scanned 10 volunteers each using 3Shape TRIOS 3. Average scanning time decreased from 23 min 9 s (first) to 15 min 28 s (tenth), a difference of 7 min 41 s. Image count dropped from 1964.5 (first) to 1468.6 (tenth).
3. 2025 in vitro study comparing conventional impressions, intraoral scanners and photogrammetry systems. Photogrammetry median deviation 25-28 μm ; conventional impressions 66 μm ; intraoral scanning 78 μm . Photogrammetry achieved highest accuracy for full-arch implants.
4. New West Lab (2022). Clinical benefits of digital impressions: 40% fewer crown remakes due to margin issues; 33% fewer remakes caused by fit issues; 27% fewer complaints about high occlusion; \$20 digital savings per unit on model-less all-ceramic restorations; \$40 off per unit on custom abutments and screw-retained implant crowns.
5. 3Shape TRIOS 5 specifications and features. Calibration-free design; device dimensions $3.8 \times 3.7 \times 26.6$ cm; weight 299 g including battery; battery life up to 66 minutes scanning; built-in ScanAssist engine for intelligent alignment.
6. Dentsply Sirona Primescan 2 (2024). Cloud-native platform with DS Core integration; full-arch scans under one minute; narrow tip for posterior access; automatic software updates; single-use and sterilizable sleeves; handpiece weight ≈ 300 g.
7. iTero Lumina Multi-Direct Capture technology. Field of view three times larger than previous models; capture depth up to 25 mm; wand 50% smaller and 45% lighter than earlier iTero scanners.

8. Align Technology press release: iTero Lumina launched February 2024 for orthodontics; later update added restorative workflows for single-unit to full-arch scanning in one pass.
9. Shining3D Aoralscan Elite hybrid scanner. Combines intraoral scanning with photogrammetry; dual structured-light and photogrammetry scanning principle; handpiece weight 124 g (without cable); scan depth 22 mm; improved accuracy for multiple implants.
10. How does the consecutive use of intraoral scanners affect muscle activation and fatigue? NIH (2024). Wireless IOS (328 g) showed significantly higher EMG values and muscle fatigue in arm, neck, and shoulder muscles compared to wired IOS (280 g). Muscle fatigue increased markedly during fourth consecutive scanning task. Weight difference of 48 g creates measurable increase in muscle activation.
11. Pilot trial evaluating scanning strategies. NIH. Overlapping wave buccal-palatal (OWBP) protocol achieved highest trueness (mean deviation 1-24 μm); scanning shorter spans improved precision significantly.
12. Effect of mouth opening on accuracy of digital impressions with Trios 5 and Helios 600. NIH (2025). At 28 mm mouth opening, Helios 600 exhibited significantly lower 2D and 3D precision compared to TRIOS 5 ($p < 0.05$). No significant differences at 33 mm and 37 mm openings. Restricted mouth opening challenges scanner maneuverability.
13. Comprehensive review of factors influencing IOS accuracy. Wet conditions significantly impaired scanning accuracy. Blow-drying tooth surface before scanning effectively reduced errors. Drier surfaces recommended to enhance scanning accuracy.
14. 3Shape TRIOS "Golden Rules" and hardware support tips. Calibration (except TRIOS 5), check scanning window for scratches, warm the tip, dry the teeth, retract soft tissues, avoid the dental lamp, watch scanner display (greyscale image most important), clean scanner tip, avoid lifting wand too far, lock surfaces for implants, wait for "snap" in bite registration.
15. 3Shape Support and Global Dental Solutions best practices. Greyscale image becomes the case file; isolation systems and moisture control recommendations.
16. 3Shape Support: Post-processing issues. Recommended image count 2000-2500 per full-jaw scan; >5000 images cause post-processing failures.

17. Splinting intraoral scan bodies (ISBs). Cappare et al. (2019) randomized clinical trial: splinted scan bodies with digital scans achieved accuracy comparable to conventional method with advantages in patient comfort and time.

18. Comparison of learning curves for Trios 4 and Primescan. TRIOS 4 reaches plateau by 11th scan (~133.6 seconds); Primescan by 14th (~147 seconds). Device-specific learning curves depend on imaging technology and software interface complexity.

16.2 Complete reference links for e-book citations

Core research references and manufacturer links are compiled for verification and further study. All links were active and verified as of October 2025. See source list in the original document for URLs to PMC articles, manufacturer specifications, and support portals.

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