**MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal**
**ISSN: 1053-7899**
**Vol. 36 Issue 2, 2026, Pages 153-155**

# Elastic Chain Reinforced Scan Body Stabilization Technique for Improving Cross Arch Accuracy in Mandibular Full-Arch Digital Implant Impressions: A Two Case Series with Literature Review

**Dr. Abhishek Dotiya[1], Dr. Sam Jebaraj[2], Dr. Aditya Dotiya[3], Dr. Ritvija C[4], Dr. Thiyaneswaran Nesappan[5]**

[1]Post Graduate Resident, Department of Implantology, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, 162, Poonamallee High Road, Velappanchavadi, Chennai-600077

[2]Senior Lecturer, Department of Implantology, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences, 162, Poonamallee High Road, Velappanchavadi, Chennai-600077

[3]Post Graduate Resident, Department of Implantology, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, 162, Poonamallee High Road, Velappanchavadi, Chennai-600077

[4]Post Graduate Resident, Department of Implantology, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, 162, Poonamallee High Road, Velappanchavadi, Chennai-600077

[5]Professor and Head of the Department, Department of Implantology, Saveetha Dental College and Hospital, Saveetha Institute of Medical And Technical Sciences, 162, Poonamallee High Road, Velappanchavadi, Chennai-600077

**Abstract**

Digital workflows have significantly advanced full-arch implant rehabilitation; however, mandibular full-arch digital impressions remain prone to cumulative stitching distortion due to anatomical and environmental challenges inherent to the lower arch. Limited attached mucosa, absence of palatal reference structures, saliva pooling, and dynamic soft tissues may compromise scan continuity in All on 4 and All on 6 rehabilitations. This report describes a novel chairside stabilization technique using orthodontic elastic chains reinforced with flowable composite to create a rigid inter-scan body reference structure during digital acquisition. Two delayed-loading mandibular full-arch implant rehabilitations were treated. Case 1 involved six Neodent, PrimeTaper implants restored at the multi-unit level. Case 2 involved four bredent CopaSky implants placed according to the All-on-4 concept with posterior 30 degree angulated multi-unit abutments. In both cases, PEEK scan bodies were splinted intraorally using elastic chains coated with flowable composite and light-cured prior to scanning. Digital impressions were obtained using a Medit intraoral scanner in Case 1 and a 3Shape TRIOS 3 in Case 2. Direct metal laser sintered titanium verification bars were fabricated from the digital files and evaluated clinically using the single screw test and radiographic assessment. Both cases demonstrated complete passive fit without the need for adjustment. Within the limitations of this case series, the proposed technique appears to enhance scan continuity and may reduce cumulative cross-arch distortion in mandibular full-arch digital implant impressions.

## 1. Introduction

The adoption of intraoral scanners (IOS) has significantly transformed implant prosthodontics by eliminating conventional impression materials, reducing chairside time, and enabling direct CAD-CAM fabrication of definitive restorations [1–4]. Numerous studies have demonstrated high accuracy of digital impressions for short-span implant restorations [5–7]. However, the accuracy of full-arch digital implant impressions remains controversial, particularly in edentulous arches [8–10].Full-arch implant impressions demand precise transfer of inter-implant spatial relationships. Passive fit of the definitive prosthesis is critical to minimize mechanical complications such as screw loosening, framework fracture, and peri-implant stress concentration [11–13]. While digital impressions eliminate material shrinkage and distortion inherent to conventional impressions, they remain dependent on image stitching algorithms. Cumulative stitching error across long spans has been identified as a primary source of inaccuracy in full-arch digital workflows [14–16].Mandibular arches present distinct challenges compared to maxillary arches. The absence of a stable palatal vault reduces fixed geometric reference landmarks [17,18]. Limited keratinized mucosa, dynamic tongue movement, and saliva pooling further compromise optical data acquisition [6,19]. Studies have shown that edentulous full-arch scans demonstrate lower trueness and precision compared to partially dentate scans due to lack of stable reference anatomy [7,20].In conventional analog workflows, splinting impression copings with acrylic resin improves impression accuracy by reducing positional discrepancies [13]. Although digital workflows eliminate impression material distortion, they still rely on stable geometric referencing during scanning. The present technique adapts the splinting concept to digital workflows by temporarily creating a rigid inter-scan body framework intraorally prior to digital acquisition [9,15].

## 2. Case Presentations

### 2.1 Case 1: Mandibular All-on-6 Rehabilitation

**2.1.1 Surgical Placement and Healing Phase:** Six straight PrimeTaper *(Densply Sirona, North Carolina, USA)* Implant fixtures were placed in an edentulous mandible following standard surgical protocols. Implant positioning was planned to achieve optimal anteroposterior spread and parallelism suitable for a full-arch fixed prosthesis. A delayed loading protocol was adopted to allow adequate osseointegration and minimize biomechanical stress during the healing phase.

After completion of the healing period, second-stage surgery was performed for implant uncovery. Cover screws were removed, and straight multi-unit abutments were connected to all six implants. The abutments were torqued according to the manufacturer's recommended torque values to ensure optimal preload, mechanical stability, and uniform seating. Proper adaptation and alignment of all abutments were clinically verified prior to initiating the digital impression workflow.

**2.1.2 Scan Body Placement and Verification:** Polyether ether ketone (PEEK) scan bodies compatible with the multi-unit abutments were secured onto each abutment. Careful attention was paid to confirm complete seating and correct rotational orientation before final tightening. Accurate seating at this stage was critical, as any vertical or rotational discrepancy could result in prosthetic misfit in the definitive restoration. Visual inspection and tactile verification were performed to ensure precise adaptation of all scan bodies.

**2.1.3 Splinting Protocol for Full-Arch Accuracy:** To enhance positional accuracy during digital impression making and to minimize potential micro-movements of individual scan bodies, a splinting protocol was implemented. An orthodontic elastic chain was adapted sequentially across all six scan bodies, extending from the distal-most implant on one side to the distal-most implant on the contralateral side.

The elastic chain was stabilized and reinforced using a light-cured flowable composite resin. The composite material was carefully applied interproximally to connect adjacent scan bodies while avoiding extension onto surrounding soft tissues or occlusal surfaces that could interfere with scanner access. After adequate light polymerization, a semi rigid, bar-like splinting assembly was formed. This configuration effectively created a continuous geometric track across the entire arch. The splinting approach served two primary purposes. First, it reduced the risk of independent displacement or rotational movement of individual scan bodies during intraoral scanning. Second, it established a unified reference framework, thereby improving the trueness and precision of full-arch digital acquisition.

**2.1.4 Digital Impression Procedure:** Digital impressions were obtained using the Medit i700 Intraoral Scanner *(Medit, Seoul, South Korea)*, following the manufacturer's recommended scanning protocol for full-arch implant cases. Scanning was initiated from one posterior segment and progressed sequentially toward the contralateral side in a continuous motion. Particular attention was given to maintaining consistent scanner angulation and avoiding abrupt directional changes to minimize stitching errors. The splinted assembly and surrounding peri-implant soft tissues were comprehensively captured to ensure accurate digital representation of the implant positions and mucosal contours (Figure 1).Immediately after completion of the digital scan, the splinting assembly comprising the elastic chain and composite resin was carefully removed to prevent undue stress on the abutments. Healing caps were subsequently placed to protect the peri-implant tissues until delivery of the definitive prosthesis.

**Figure 1:** Case 1 (A) Occlusal view of the scan; (B) Buccal view of the scan

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
ISSN: 1053-7899
Vol. 36 Issue 2, 2026, Pages 153-155

**2.1.5 Fabrication of Verification Bar:** Based on the acquired digital dataset, a verification jig was fabricated using direct metal laser sintering (DMLS) technology in titanium alloy. The verification bar was digitally designed to precisely replicate the three-dimensional spatial orientation of the six implants as captured during the scanning procedure.

**2.1.6 Clinical and Radiographic Verification of Passive Fit:** Clinical verification of passive fit was performed using the single-screw test. The verification bar was secured to one terminal implant using the recommended torque value, while seating at the remaining implant interfaces was evaluated. No lifting, rocking, or marginal discrepancies were observed at the unfastened sites, indicating passive adaptation. Further confirmation was obtained radiographically using radiography (RVG). Periapical radiographs were taken at each implant abutment interface to assess marginal adaptation. Radiographic evaluation demonstrated complete seating of the verification bar at all six interfaces without detectable radiolucent gaps (Figure 2).

This workflow ensured an accurate digital transfer of implant positions in a six-implant full-arch rehabilitation case and validated the effectiveness of splinted PEEK scan bodies in enhancing the precision of intraoral digital impressions for multi-unit implant-supported prostheses.

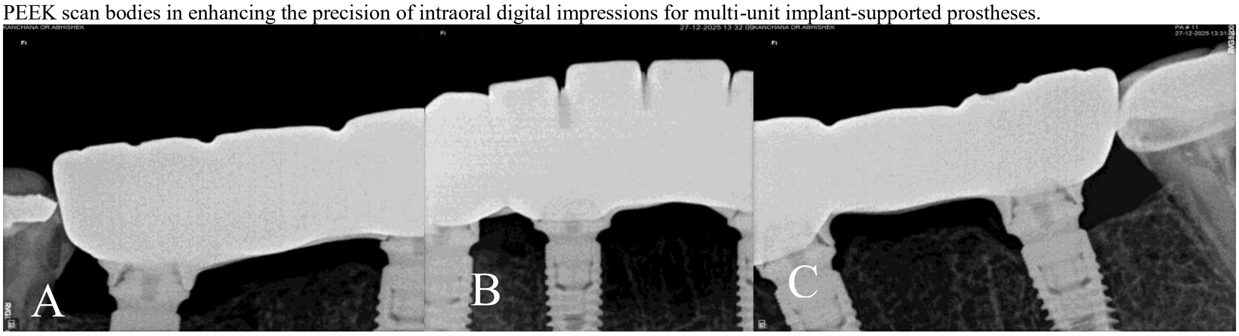


**Figure 2:** Case 1 Radiographic evaluation of the seating of the prosthesis.

**2.2 Case 2: Mandibular All-on-4 Rehabilitation**

**2.2.1 Surgical Placement and Healing Phase:** Four CopaSky Implants *(Bredent, GmbH, Germany)* were placed in an edentulous mandible following the All-on-4 treatment concept. The two anterior implants were positioned axially in the interforaminal region to achieve optimal primary stability and favorable prosthetic positioning. The two posterior implants were inserted with a distal angulation of approximately 30 degrees to increase the anterior posterior spread and reduce cantilever length. Immediately after implant placement, multi-unit abutments were connected to evaluate prosthetic angulation and confirm correction of the tilted posterior implants. This step ensured that an appropriate restorative path of insertion could be achieved. After verifying the angulation and prosthetic feasibility, the multi-unit abutments were removed. Cover screws were placed, and the implants were left submerged to heal under a delayed loading protocol.

A healing period of three months was allowed to facilitate osseointegration. Following this period, second-stage surgery (implant uncovery) was performed. The cover screws were removed, and definitive multi-unit abutments were placed and torqued according to the manufacturer's recommended values. Proper seating and alignment of all abutments were clinically verified prior to proceeding with the digital impression workflow.

**2.2.2 Scan Body Placement and Verification:** Polyether ether ketone (PEEK) scan bodies compatible with the multi-unit abutments were attached. Each scan body was carefully inspected to confirm complete seating and accurate rotational orientation. Ensuring precise adaptation at this stage was critical, as any positional discrepancy could compromise the accuracy of the definitive prosthesis.

**2.2.3 Splinting Protocol for Scan Bodies:** To enhance the accuracy of full-arch digital acquisition and minimize micromovement during scanning, a splinting protocol was implemented. An orthodontic elastic chain was adapted sequentially across all four scan bodies, extending from one posterior implant to the contralateral posterior implant. The elastic chain was reinforced with a light-cured flowable composite resin applied between adjacent scan bodies. After adequate polymerization, a semi rigid bar-like structure was formed, effectively uniting the scan bodies into a continuous geometric assembly across the arch.

Additionally, a cross-arch reinforcement was created between the two distal implants to further enhance stability. This supplementary connection minimized potential torsional displacement during scanning, which is particularly important in cases involving tilted posterior implants. The final splinted configuration provided a stable reference framework, thereby improving trueness and precision during digital data acquisition.

**2.2.4 Digital Impression Procedure:** Digital scanning was performed using the 3Shape TRIOS 3 *(3Shape, Copenhagen, Denmark).* The scanning protocol followed a systematic full-arch approach, beginning from one posterior segment and progressing continuously to the contralateral side (Figure 3). Care was taken to maintain consistent scanner angulation and uninterrupted scanning to reduce stitching errors and ensure comprehensive capture of the splinted scan bodies, peri-implant soft tissues, and adjacent anatomical landmarks.

Upon completion of the scan, the composite-reinforced elastic splinting assembly was carefully removed. Healing caps were placed to protect the peri-implant tissues until prosthesis delivery.

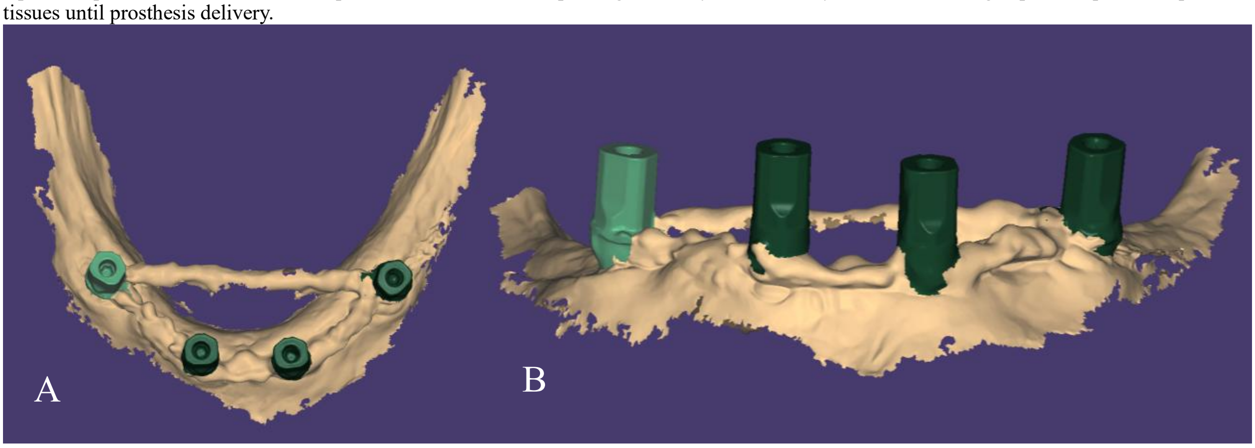


**Figure 3:** Case 2 (A) Occlusal view of the scan; (B) Buccal view of the scan

**2.2.5 Fabrication of Verification Bar**

Based on the digital dataset, a verification jig was fabricated using direct metal laser sintering (DMLS) technology in titanium alloy. The verification bar was designed to replicate the three-dimensional spatial orientation of the implants as captured during the digital workflow.

**2.2.6 Clinical and Radiographic Verification of Passive Fit**

Passive fit was assessed clinically using the single-screw test. The verification bar was secured to one terminal implant while the seating at the remaining implant interfaces was evaluated. No lifting, rocking, or marginal discrepancies were observed, indicating passive adaptation (Figure 4).

Radiographic verification using periapical radiography demonstrated complete seating of the verification bar at all implant–abutment interfaces, with no detectable radiolucent gaps. No adjustments were required, confirming the accuracy of the digital impression and splinted scan body protocol in this delayed loading All-on-4 rehabilitation case.

**MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal**
**ISSN: 1053-7899**
**Vol. 36 Issue 2, 2026, Pages 153-155**

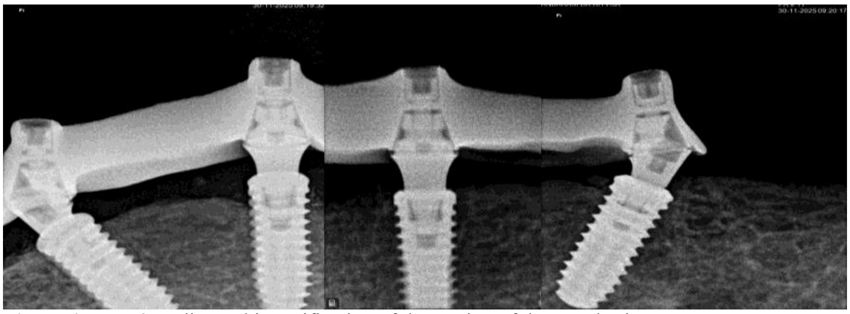

**Figure 4:** Case 2 Radiographic verification of the seating of the prosthesis.

3. **Results:** Both clinical cases completed the digital impression workflow without intraoperative complications. The composite-reinforced elastic chain stabilization assembly remained stable throughout the scanning procedure in both cases and did not exhibit displacement, detachment, or interference with scan body geometry during image acquisition. The scanning process was completed without the need for rescanning segments or correcting stitching errors.

In Case 1, involving six PrimeTaper implants restored at the multi-unit level, the digital dataset was exported without visible discontinuities or stitching artifacts across the arch. The inter-scan body relationships appeared uniform and continuous in the three-dimensional reconstruction. A direct metal laser sintered titanium verification bar fabricated from the digital impression seated fully on the multi-unit abutments. When the single-screw test was performed by tightening one terminal screw, no lifting or gap was observed at the remaining implant interfaces. Radiographic evaluation of each implant abutment interface confirmed complete seating without radiolucent gaps or misalignment. No adjustment of the framework was required prior to definitive prosthesis fabrication.

In Case 2, involving four bredent CopaSky implants placed according to the All-on-4 protocol with posterior 30-degree multi-unit abutments, the digital impression similarly demonstrated uninterrupted continuity across the arch. The reinforced configuration connecting implant positions sequentially and cross-arch provided stable acquisition during scanning with the 3Shape TRIOS 3 intraoral scanner. The resulting digital model displayed consistent scan body morphology and alignment without visible stitching distortion. The DMLS titanium verification bar fabricated from the digital file demonstrated complete passive seating at the multi-unit level. Upon application of the single-screw test at one distal implant, no displacement, rocking, or gap formation was observed at the remaining abutments. Radiographic verification confirmed intimate contact at all implant–abutment junctions. No occlusal or internal surface adjustment of the framework was necessary before proceeding to definitive superstructure fabrication.

Across both cases, no prosthetic complications were encountered during framework try-in. There were no clinical signs of strain during screw tightening, and screw insertion was smooth and without resistance. Healing caps were replaced immediately after impression making without soft tissue disturbance. Definitive prostheses fabricated on the verified frameworks were delivered without evidence of misfit or mechanical discrepancy.

4. **Discussion:** Several investigations have reported that full-arch digital impressions may demonstrate greater deviation compared with conventional impressions, particularly in edentulous arches [8,14]. Cross-arch distortion tends to increase progressively from the starting scan region toward the contralateral side, suggesting cumulative stitching deviation [3,16]. Mandibular arches may present even greater scanning challenges due to absence of palatal support and greater soft tissue mobility [17]. Saliva pooling has also been reported to reduce optical clarity and affect scanning reliability [6]. Additionally, scan body design and spacing may significantly influence digital impression accuracy [10,18].The present stabilization technique may enhance scanning accuracy through several mechanisms. First, the composite-reinforced elastic chain provides a continuous geometric reference across scan bodies. Second, the rigid interconnection may minimize relative micromovement during scanning. Third, the reinforced structure may assist stitching algorithms by providing stable spatial geometry across the arch [4,15].

Passive seating of the verification bar remains a widely accepted clinical indicator of impression accuracy in implant prosthodontics [11]. Although quantitative deviation analysis was not performed in this report, the absence of misfit during the single-screw test supports the clinical feasibility of the proposed approach.

## 5. Conclusion

Mandibular full-arch digital implant impressions remain inherently vulnerable to cumulative stitching distortion due to the absence of stable palatal reference structures, limited keratinized mucosa, saliva pooling, and dynamic soft tissue interference. These anatomical and environmental factors can compromise cross-arch accuracy and jeopardize passive fit in implant-supported full-arch prostheses.The elastic chain reinforced scan body stabilization technique described in this report represents a pragmatic adaptation of the conventional splinting principle to a contemporary digital workflow. By temporarily creating a rigid inter-scan body framework prior to image acquisition, the technique provides a continuous geometric reference across the arch, thereby supporting stitching algorithms and potentially reducing cumulative cross-arch deviation. In both All-on-6 and All-on-4 mandibular rehabilitations, digital impressions obtained using this method resulted in direct metal laser sintered titanium verification bars that exhibited complete passive seating, confirmed clinically by the single-screw test and radiographically by RVG evaluation, without the need for any adjustment.The technique is cost effective, reversible, minimally technique-sensitive, and compatible with different implant systems and intraoral scanners. Its integration into routine clinical practice requires no additional laboratory procedures and introduces negligible chairside time.Although quantitative three-dimensional deviation analysis was beyond the scope of this report, the consistent achievement of passive fit in both cases supports the clinical feasibility of this stabilization approach. Future controlled investigations incorporating digital superimposition analysis, trueness and precision assessment, and comparative evaluation against conventional digital protocols are warranted to validate its accuracy objectively.

Within the limitations of this case series, the elastic chain reinforced scan body stabilization technique appears to be a clinically effective adjunct for enhancing the predictability and reliability of mandibular full-arch digital implant impressions.

## 6. References

Mangano F, Gandolfi A, Luongo G, Logozzo S. Intraoral scanners in dentistry: A review of the current literature. *BMC Oral Health*. 2017.
Kachhara S, Nallaswamy D, Ganapathy DM, Sivaswamy V. Assessment of intraoral scanning technology for multiple implant impressions. *J Indian Prosthodont Soc*. 2020.
Ender A, Mehl A. Accuracy of complete-arch dental impressions. *J Prosthet Dent*. 2013.
Shenoy A, Maiti S, Nallaswamy D, Ganapathy DM. Direct and indirect data acquisition methods in implant prosthodontics. *Int J Prosthodont Restor Dent*.
Gimenez-Gonzalez B, Hassan B, Özcan M. Accuracy of digital impressions in implant dentistry. *Clin Oral Implants Res*. 2017.
Ganapathy DM, Nallaswamy D. Knowledge and practice of dental impression techniques among practitioners. *Int J Pharm Res*.
Amin S, Weber HP. Digital vs conventional full-arch implant impressions. *Clin Oral Implants Res*. 2017.
Vandeweghe S, Vervack V. Accuracy of digital impressions of multiple implants. *Clin Oral Implants Res*. 2017.
Maiti S, Nallaswamy D, Ganapathy DM. Effect of cut-out rescanning protocol on digital implant impression accuracy. *J Dent*.
Mizumoto RM, Yilmaz B. Intraoral scan bodies in implant dentistry. *J Prosthet Dent*. 2018.
Jemt T. Failures and complications in implant-supported prostheses. *Int J Oral Maxillofac Implants*. 1991.
Nallaswamy D, Ganapathy DM. Digital prosthodontic workflow outcomes. *Cureus*.
Assif D, Marshak B. Accuracy of implant impression techniques. *Int J Oral Maxillofac Implants*. 1996.
Keul C, Güth JF. Accuracy of full-arch digital impressions. *Clin Oral Investig*. 2020.
Maiti S, Nallaswamy D. Evaluation of modified open tray implant impression technique.
Ender A, Attin T, Mehl A. In vivo precision of digital impressions. *J Prosthet Dent*. 2016.
Schmidt A, Billig JW. Influence of scanning strategy on digital impressions. *J Prosthodont*. 2020.
Ariga P, Nallaswamy D, Jain AR, Ganapathy DM. Correlation of maxillary anterior tooth width using intraoral measurements. *World J Dent*.
Rutkunas V. Accuracy of digital implant impressions with intraoral scanners. *J Prosthodont*. 2017.
Maiti S, Nallaswamy D, Ganapathy DM. Comparison of open-tray and closed-tray implant impression techniques.