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Anterior Esthetic Rehabilitation Using Socket Shield Technique with Immediate Implant Placement– A Case Report

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ABSTRACT

Anterior Tooth Replacement Poses Significant Esthetic And Functional Challenges, Particularly In Cases Requiring Extraction In The Maxillary Esthetic Zone. The Socket Shield Technique (Sst), A Form Of Partial Extraction Therapy, Offers A Biologically Driven Approach To Preserve The Buccal Root Segment And Maintain The Surrounding Bone And Soft Tissue Architecture. This Case Report Presents The Management Of A 35-Year-Old Female Patient With A Fractured Maxillary Right Lateral Incisor, Treated Using Sst With Immediate Implant Placement And Provisionalization. Atraumatic Decoronation, Careful Root Sectioning, And Shield Preparation Were Followed By Palatal Osteotomy, Implant Placement, Bone Grafting, And The Fabrication Of A Screw-Retained Provisional Crown. The Technique Preserved The Facial Contour, Prevented Soft Tissue Collapse, And Allowed For A Seamless Esthetic Transition. The Patient Demonstrated Excellent Healing With No Postoperative Complications. This Report Highlights The Clinical Relevance And Predictability Of Sst In Optimizing Esthetic Outcomes And Accelerating Rehabilitation In The Anterior Maxilla When Executed With Precision.

KEYWORDS: Socket shield technique, immediate implant placement, anterior esthetics, partial extraction therapy

Introduction

The replacement of maxillary anterior teeth presents a unique clinical challenge due to the dual imperative of restoring both esthetics and function. These teeth are fundamental not only for phonetics and mastication but also for facial esthetics, providing lip support and contributing significantly to the overall smile harmony. Following extraction, the anterior maxilla is particularly prone to alveolar ridge resorption, which occurs predominantly in the palatal and apical directions [1]. This loss of hard tissue is further compounded by the collapse of the overlying soft tissue architecture due to the disruption of the periodontal ligament and its vascular network, leading to esthetic and functional compromises that are often difficult to reverse.

In response to these challenges, implant dentistry has evolved with a strong focus on tissue preservation and immediate rehabilitation. One such innovative approach is the Socket Shield Technique (SST), a procedure categorized under the broader concept of Partial Extraction Therapy (PET) [2]. SST involves the retention of a portion of the tooth root, typically the buccal segment, to preserve the periodontal ligament and bundle bone, which are critical in maintaining alveolar ridge volume and gingival contours [3]. When combined with immediate implant placement and provisionalization, this technique

offers the advantage of reducing overall treatment time, preserving peri-implant soft tissue esthetics, and minimizing the risk

Of Post-Extraction Bone Resorption And Gingival Recession [4].

This Case Report Describes The Application Of The Socket Shield Technique With Immediate Implant Placement And Loading In A Patient Requiring Extraction Of A Maxillary Right Lateral Incisor. The Case Highlights A Comprehensive And Minimally Invasive Protocol Aimed At Maximizing Esthetic Outcomes In The Anterior Maxilla, While Adhering To The Principles Of Biological Preservation And Functional Restoration.

Case Report

Patient History And Clinical Assessment

A 35-Year-Old Female Patient Reported To The Department With A Fractured Post And Crown In Relation To The Maxillary Right Lateral Incisor (Tooth #12). She Was Particularly Concerned About The Esthetic Compromise And Sought A Fixed, Immediate Solution. Upon Clinical Evaluation, The Fractured Post Was Visible Intraorally And Confirmed Non-Restorable. The Surrounding Soft Tissue Appeared Healthy With No Signs Of Inflammation. Adjacent Teeth Were Stable And Intact, And Periodontal Probing Revealed No Pocketing. The Patient's Medical History Was Non-Contributory, And She Was Systemically Healthy. She Was A Non-Smoker And Maintained Acceptable Oral Hygiene. Importantly, She Refused The Use Of Any Removable Prosthesis During The Treatment Duration, Strongly Preferring A Fixed, Esthetic Outcome.

A Periapical Radiograph Showed No Evidence Of Periapical Pathology Or Root Resorption. Cone-Beam Computed Tomography (Cbct) Was Performed To Assess Bone Quality And Morphology. The Scan Revealed A Ridge Width Of 4.8 Mm In The Bucco-Palatal Dimension And A Vertical Bone Height Of 9.5 Mm From The Alveolar Crest To The Apex. Bone Quality Was Classified As D2, Making It Favorable For Immediate Implant Placement. Clinical Bone Sounding Measurements Showed Approximately 3 Mm Of Bone Thickness On The Facial Aspect And 4.5 Mm Interproximally. Given These Conditions, A Decision Was Made To Proceed With A Socket Shield Technique (Sst) Followed By Immediate Implant Placement And Provisionalization.

Preoperative Planning And Preparations

The Treatment Plan Was Discussed With The Patient In Detail, Including The Nature And Steps Of The Socket Shield Technique, Immediate Implant Placement, And Fabrication Of A Screw-Retained Provisional Restoration. Informed Consent Was Obtained. Preoperative Blood Investigations Including Complete Blood Count (Cbc), Bleeding And Clotting Times, Hba1c, And Serum Vitamin D Were All Within Normal Limits. The Patient Was Premedicated With Amoxicillin-Clavulanate (Tab. Augmentin 625 Mg) Beginning One Day Before Surgery And Continued On The Day Of The Procedure To Minimize Infection Risk.

Surgical Procedure

On The Day Of Surgery, Local Anesthesia Was Administered Using 2% Lidocaine With 1:100,000 Epinephrine. The Tooth Was Decoronated To The Level Of The Gingiva Using A Contra-Angled Surgical Handpiece Equipped With A Diamond Bur Under Copious Saline Irrigation. Care Was Taken To Preserve The Gingival Margins And Interdental Papillae.

Following Decoronation, A Long-Shank Surgical Root Resection Bur Was Employed To Section The Root Longitudinally In A Mesiodistal Direction Through The Center Of The Canal. The Division Was Carried Out From The Coronal Portion Of The Root All The Way To The Apex, Effectively Separating The Buccal And Palatal Root Halves. Precision And Light Pressure Were Maintained Throughout To Avoid Breaching The Socket Walls Or Damaging Adjacent Teeth.

Once Adequate Separation Was Achieved, The Palatal Root Fragment Was Atraumatically Removed Using Fine Microforceps, Ensuring That The Labial Segment Remained Firmly Embedded In The Socket With Its Periodontal Ligament Intact. To Facilitate Proper Adaptation Of Soft Tissues And Prevent Shield Exposure, The Internal (Pulpal)

Surface Of The Retained Labial Root Fragment Was Reduced Using An Extra-Large Round Diamond Bur To Form A Gentle Concavity (Figure 1). The Coronal Extent Of The Shield Was Carefully Trimmed Using An End-Cutting Diamond Bur To Match The Level Of The Adjacent Alveolar Crest. Throughout This Process, A Gingival Protector Was Used To Prevent Accidental Injury To The Labial Gingiva And Papillary Tissues.

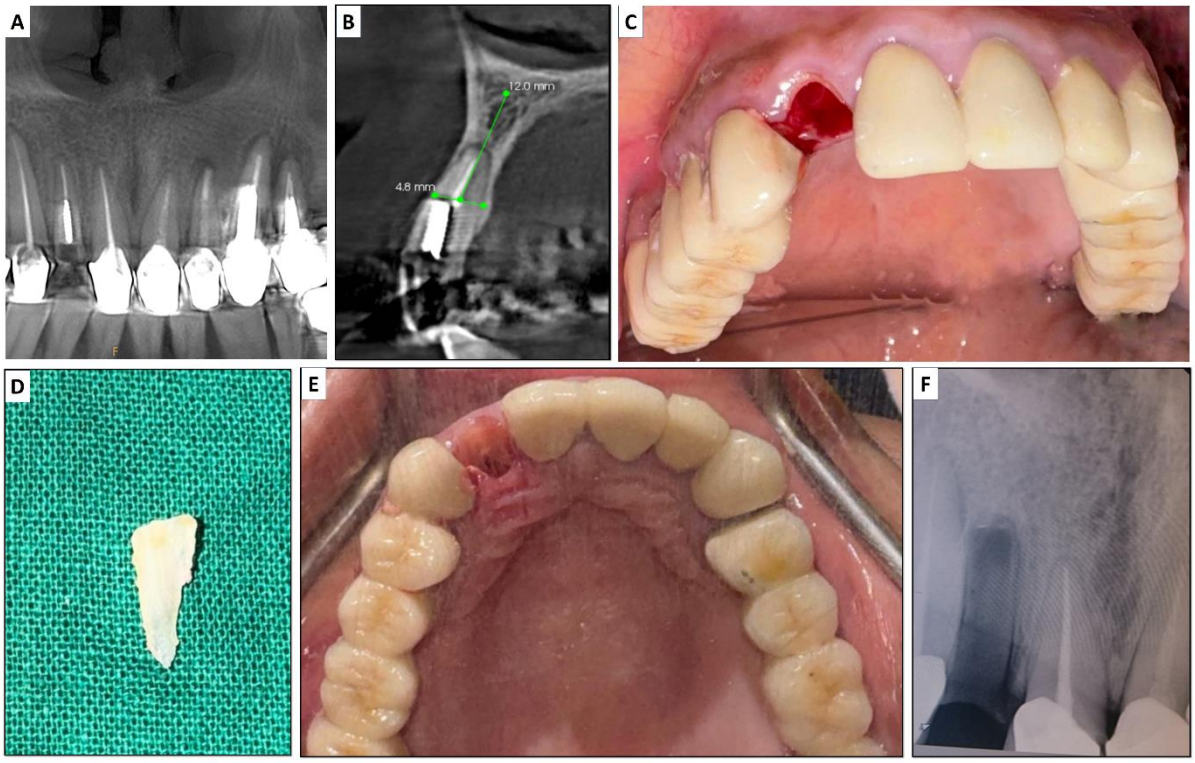

Figure 1: Pre-Operative Cone Beam Volumetric Imaging From A) Frontal View And B) Sagittal View; C) Intra-Oral Decoronated Tooth; D) Sectioning Of Root With Extracted Palatal Segment; E) Retained Labial Segment Of Root In The Socket; F) Radiograph Of The Retained Labial Segment.

A Minimal Flap Was Reflected On The Labial Aspect To Gain Visual And Tactile Access To The Socket And Verify The Stability Of The Shield. The Osteotomy Site For Implant Placement Was Initiated From The Palatal Wall Of The Extraction Socket Using An Irrigated Surgical Motor And Surgical Drills Following The Manufacturer's Protocol. Sequential Drilling Was Done Carefully To Avoid Disturbing The Shield. A 3.5 Mm × 12 Mm Bredent Blue Sky Implant With A Straight Body And Dome-Shaped Apex Was Inserted, Achieving A Final Insertion Torque Of 35 Ncm, Indicative Of Good Primary Stability. The Space Between The Implant And The Socket Wall Was Grafted Using Deproteinized Bovine Bone Mineral (Bio-Oss) To Ensure Adequate Volume Maintenance. A Platelet-Rich Fibrin (Prf) Membrane, Prepared From The Patient's Own Blood, Was Placed Over The Graft To Enhance Healing And Soft Tissue Integration (Figure 2).

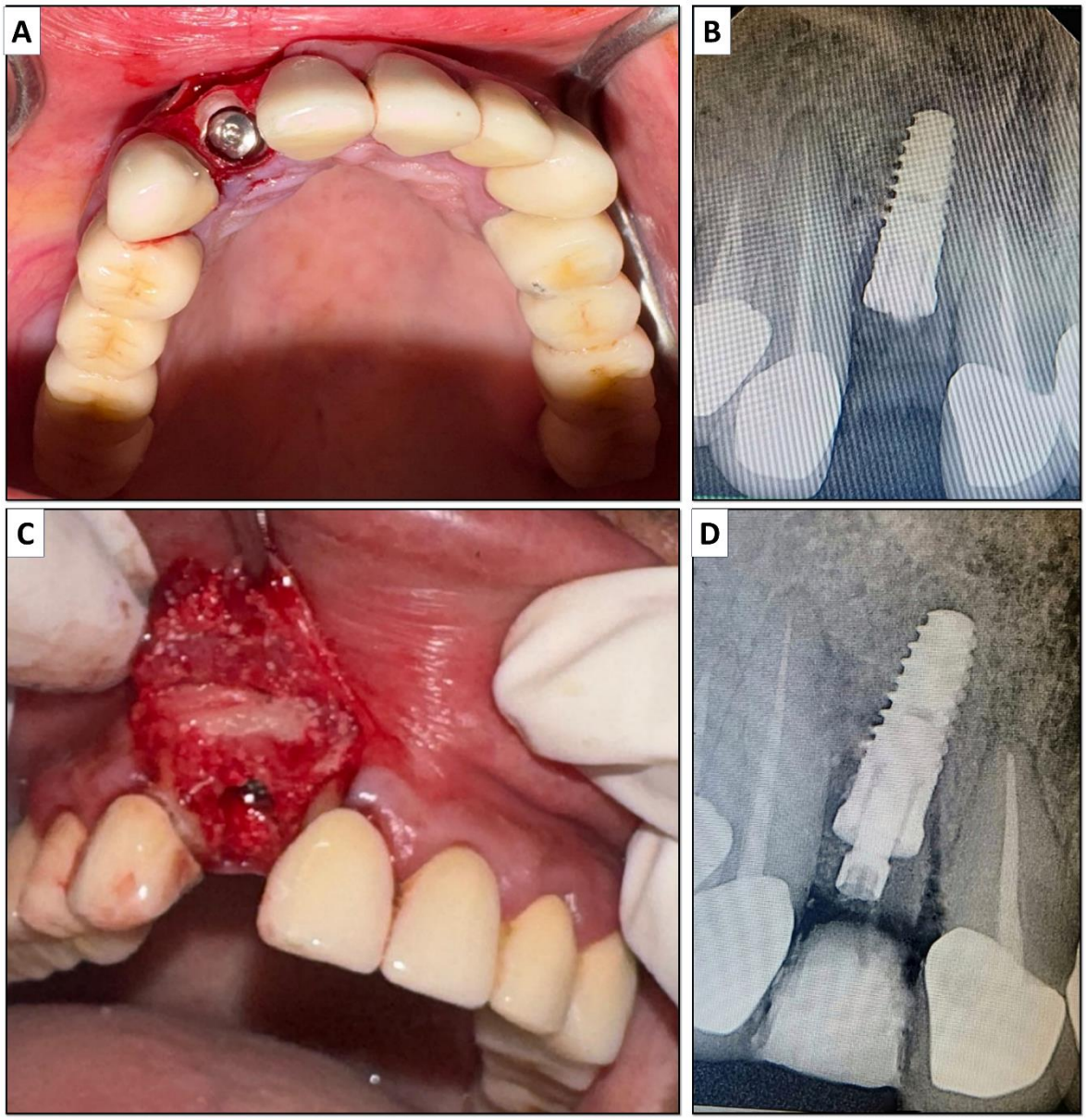

Figure 2: Immediate Implant Placement; B) Radiograph After Implant Placement; C) Bone Graft And Membrane For Bone Augmentation; D) Post-Temporization Radiovisiograph.

Provisional Restoration Protocol

Following Implant Placement, The Surgical Site Was Gently Irrigated And Inspected For Any Signs Of Shield Mobility Or Excessive Bleeding. Once Stability Was Confirmed, The Focus Shifted To Prosthetic Rehabilitation. A Temporary Abutment Was Selected Such That It Allowed For A Narrow Emergence At The Cervical Area Which Then Flared To Match The Natural Contour Of The Crown. The Goal Was To Avoid Exerting Pressure On The Socket Shield And Preserve The Delicate Peri-Implant Soft Tissues.

The Abutment Was Manually Torqued And Protected With Teflon Tape To Isolate The Screw Access Channel. A Prefabricated Transparent Plastic Shell Crown Was Relined Intraorally Using A Bis-Gma-Based Composite Resin To Conform To The Soft Tissue Contours. Additional Flowable Composite Was Incrementally Added To Refine The Subgingival Emergence Profile. The Emergence Was Designed To Be Concave (S-Shaped) To Promote Soft Tissue Thickness And Sealing Over The Shield. Care Was Taken To Ensure That The Provisional Crown Did Not Have Any

Occlusal Contacts In Centric Or Eccentric Movements. The Restoration Was Adjusted And Polished To Avoid Irritation To The Gingival Margin And Then Hand-Tightened. Figure 3 Shows A Comparison Of Pre-Treatment And Post-Treatment Smile From The Frontal View.

Figure 3: Comparative Illustration Of Smiles – A) Pre-Treatment And B) Post-Treatment

Postoperative Instructions And Follow-Up

Postoperatively, The Patient Was Prescribed Tab. Augmentin 625 Mg Three Times Daily For Five Days And Tab. Enzoflam Twice Daily For Three Days To Manage Pain And Inflammation. She Was Instructed To Avoid Brushing The Surgical Area For Two Weeks And To Rinse Gently Twice Daily With 0.12% Chlorhexidine Gluconate. The Patient Was Advised To Follow A Liquid Diet For The First Week, Followed By A Soft Diet During The Entire Osseointegration Period (Approximately 4 Months). She Was Also Advised Not To Apply Any Functional Load To The Provisional Restoration.

Clinical Follow-Ups Were Scheduled At 1 Week, 1 Month, And Then Monthly To Monitor The Soft Tissue Response, Gingival Margin Position, And Healing Progress. The Soft Tissue Architecture Was Carefully Evaluated During Each Visit, And Any Signs Of Shield Exposure Or Soft Tissue Blanching Were Addressed Immediately. A Final Prosthesis Will Be Fabricated After Confirmation Of Osseointegration And Satisfactory Gingival Esthetics.

Discussion:

The Management Of Esthetic Zone Tooth Replacement Demands A Highly Nuanced Understanding Of Biological, Functional, And Psychological Factors. In This Case, The Patient Presented With A Fractured Post And Crown In The Maxillary Right Lateral Incisor, Necessitating Extraction. Given Her Esthetic Concerns, Desire To Avoid Removable Prostheses, And Favorable Systemic And Local Conditions, A Treatment Strategy Involving The Sst With Immediate Implant Placement And Provisionalization Was Deemed Optimal. The Rationale Behind This Approach Is Rooted In The Preservation Of The Buccal Root Segment, Which Maintains The Periodontal Ligament, Bundle Bone, And Surrounding Vascular Architecture. These Structures Are Typically Lost Following Extraction, Leading To Alveolar Collapse And Gingival Recession [4]. Such Sequelae Are Particularly Detrimental In The Anterior Maxilla, Where Even Minor Soft Tissue Changes Can Compromise The Overall Esthetic Result.

The Sst Employed In This Case Was Executed With Careful Planning And Surgical Precision. The Root Was Sectioned Using A Long-Shank Root Resection Bur Under Constant Irrigation To Ensure Complete Separation Of The Labial And Palatal Segments While Preserving The Integrity Of The Facial Plate. The Labial Root Fragment Was Carefully Contoured To The Required Thickness Using An Extra-Large Round Diamond Bur To Prevent Internal Exposure And To Allow For Optimal Soft Tissue Adaptation. Thecoronal Edge Of The Shield Was Trimmed Using An End-Cutting Diamond Bur To Flush With The Alveolar Crest, Preventing Interference With The Provisional Crown And Ensuring Long-Term Tissue Stability. Maintaining The Shield In A Stable, Non-Mobile Position Was Paramount To Prevent Inflammatory Complications Or Resorption [5]. The Implant Was Strategically Positioned Palatally Within The Socket To Avoid Contact With The Shield While Simultaneously Ensuring Primary Stability. This Alignment Is Essential For The Functional And Esthetic Success Of The Restoration And Allows Sufficient Space For Bone Grafting And The Development Of An Optimal Emergence Profile.

The Decision To Graft The Gap Between The Implant And Socket Wall With Xenograft Material And Cover It With A Platelet-Rich Fibrin Membrane Was Supported By Evidence Demonstrating Enhanced Bone Regeneration And Soft Tissue Healing [6]. Prf, Owing To Its Autologous Nature And Sustained Release Of Growth Factors, Supports Angiogenesis And Cellular Proliferation, Thereby Promoting Faster Integration And Reducing The Risk Of Marginal Bone Loss [7]. The Use Of A Screw-Retained Provisional Restoration, Fabricated Chairside, Allowed Immediate Contouring Of The Peri-Implant Tissues. Particular Attention Was Paid To The Emergence Profile, Which Was Kept Concave To Encourage Soft Tissue Thickening And Prevent Recession Over The Shield. The Provisional Was Maintained Completely Out Of Occlusion To Protect The Implant And Shield During The Critical Healing Phase.

This Case Also Reinforces The Significance Of Prosthetic Planning And Component Selection In Achieving Long-Term Success. The Selection Of A Narrow Emergence Temporary Abutment Permitted A Biologically Favorable Contour And Minimized Compression On The Soft Tissues And The Socket Shield [8]. Ensuring A Minimum Distance Between The Shield And The Provisional Is Critical To Allow The Gingival Tissue To Encapsulate The Shield Completely And Prevent Microbial Ingress. Furthermore, The Provisional Crown Was Carefully Polished And Contoured To Facilitate Plaque Control And Prevent Inflammation, Both Of Which Are Imperative For The Maintenance Of Mucosal Health Around The Implant.

The Success Of This Case Further Supports The Growing Body Of Literature Emphasizing The Value Of Partial Extraction Therapies Such As Sst. Multiple Studies Have Documented The Ability Of This Technique To Preserve Crestal Bone Height And Mid-Facial Gingival Levels Significantly Better Than Traditional Extraction And Delayed Implant Protocols[9,10]. However, Its Clinical Success Is Highly Technique-Sensitive. Inappropriate Shield Preparation, Residual Mobility, Or Excessive Contact From The Provisional Restoration Can Lead To Shield Exposure, Infection, Or Esthetic Failure [10]. It Is Therefore Critical That Clinicians Selecting This Approach Possess The Surgical Precision, Experience, And Understanding Of Soft-Tissue Dynamics Necessary To Anticipate And Manage Complications.

In The Present Case, All These Factors Were Carefully Accounted For. The Implant Achieved Excellent Primary Stability, The Shield Remained Stable Throughout The Healing Period, And The Patient Reported No Discomfort Or Inflammation. Regular Follow-Up Ensured That Soft Tissue Maturation Proceeded Favorably, With No Signs Of Peri-Implant Disease Or Shield Compromise. The Esthetic Result Remained Stable Through The Early Healing Phase, And Definitive Prosthesis Planning Is Underway With Anticipation Of Long-Term Functional And Esthetic Success. This Case Exemplifies How Biologically Guided Implant Protocols Like The Socket Shield Technique, When Meticulously Executed, Can Meet The Demands Of Modern Implant Dentistry By Preserving What Nature Has Provided And Optimizing What Prosthetics Can Restore.

Conclusion:

In Conclusion, This Case Report Demonstrates The Successful Application Of The Socket Shield Technique Combined With Immediate Implant Placement And Provisionalization As A Viable And Esthetically Superior Treatment Modality For Anterior Tooth Replacement. By Preserving The Buccal Root Segment And Maintaining The Native Periodontal Ligament And Bundle Bone, The Technique Effectively Minimized Post-Extraction Ridge Resorption And Preserved Soft Tissue Contours, Resulting In Enhanced Esthetic Outcomes. Careful Case Selection, Precise Surgical Execution, And Thoughtful Prosthetic Planning Were Integral To Achieving A Predictable And Biologically Favorable Result. This Approach Exemplifies A Minimally Invasive, Patient-Centered Solution That Aligns With Contemporary Principles Of Implantology And Esthetic Dentistry.

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