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Research Article

Oral Lichen Planus and Wound Healing: Surgical Implications for Oral and Maxillofacial and Reconstructive Procedures

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Abstract

Background: Surgical trauma in patients with oral lichen planus (OLP) can trigger the Köbner phenomenon, leading to severe mucosal ulceration, delayed wound re-epithelialization, and surgical site complications. This single-center retrospective cohort study evaluated the efficacy of a standardized perioperative immunomodulatory optimization protocol on post-surgical wound healing outcomes and Köbnerization rates in OLP patients undergoing oral and maxillofacial surgical procedures.

Methods: A total of 152 adult OLP patients who underwent elective soft-tissue, pre-prosthetic, or dental implant surgical procedures at a single tertiary academic medical center over a 1-year period were analyzed. Patients were stratified based on whether they received a standardized perioperative immunomodulatory protocol (Optimized Cohort, n = 80 ; topical clobetasol 0.05% ± short-course oral prednisone) or standard non-protocolized surgical care (Non-Optimized Cohort, n = 72). Primary outcomes were the incidence of postoperative Köbner phenomenon within 30

days and complete mucosal re-epithelialization time (days). Secondary outcomes included surgical site dehiscence, severe pain scores (VAS 7), and implant failure at 1 year.

Results: Baseline clinical characteristics were comparable between cohorts. The Optimized Cohort demonstrated a significantly lower incidence of the Köbner phenomenon compared to the Non-Optimized Cohort (7.5% vs. 30.6%, $p < 0.001$). Mean mucosal re-epithelialization time was markedly shorter in the Optimized Cohort (11.2 ± 2.6 { days} vs. 18.3 ± 4.2 { days} , $p < 0.001$). Multivariable logistic regression revealed that non-optimized perioperative status (aOR: 4.95, 95% CI: 1.98–12.38, $p < 0.001$), active erosive OLP subtype at baseline (aOR: 3.28, 95% CI: 1.32–8.15, $p = 0.010$), and split-thickness flap design (aOR: 2.74, 95% CI: 1.10–6.85, $p = 0.031$) were independent predictors of post-surgical Köbnerization. Among implant recipients ($n = 64$), 1-year implant success was 97.1% in the Optimized Cohort vs. 83.3% in the Non-Optimized Cohort ($p = 0.068$).

Conclusions: Preoperative immunomodulatory stabilization significantly reduces the incidence of the Köbner phenomenon, accelerates mucosal wound re-epithelialization, and minimizes postoperative complications in OLP patients undergoing oral and maxillofacial surgery.

Keywords: Oral lichen planus, wound healing, Köbner phenomenon, maxillofacial surgery, dental implants, single-center study, perioperative corticosteroids.

Introduction

Oral lichen planus (OLP) is a chronic T-cell-mediated autoimmune disease of the oral mucosa affecting 1–2% of the general population [1, 2]. Pathologically characterized by subepithelial T-lymphocyte infiltration, liquefaction degeneration of the basal cell layer, and matrix metalloproteinase dysregulation, OLP impairs normal mucosal tissue homeostasis and repair mechanisms [3, 4].

When OLP patients undergo oral, maxillofacial, or reconstructive procedures, surgical tissue manipulation induces acute localized DAMP release and stress responses that can trigger the Köbner phenomenon—the development of isomorphic lichenoid ulcerations at the surgical site [5, 6]. This reaction disrupts fibrin clot stabilization,

delays keratinocyte migration, elevates tissue friability, and increases the risk of wound dehiscence, surgical infection, and reconstructive failure [7, 8].

While clinical consensus highlights the importance of disease quiescence before surgery, empirical clinical data quantifying the impact of standardized perioperative medical control on objective wound healing parameters remain limited. This study aimed to compare surgical wound healing outcomes, Köbnerization rates, and complication profiles in OLP patients managed with a standardized perioperative immunomodulatory protocol versus non-optimized controls within a unified clinical setting.

Materials and Methods

Study Design and Patient Population

A retrospective cohort study was conducted analyzing consecutive clinical records of adult patients (18 years) with histologically confirmed OLP who underwent elective oral and maxillofacial procedures at Islam Medical and Dental College, Sialkot tertiary care academic medical center. Study ethics approval was obtained from the institutional review board.

Inclusion criteria comprised:

1. Histologically and clinically diagnosed OLP (reticular, erythematous/atrophic, or erosive subtypes).
2. Elective minor-to-moderate oral and maxillofacial surgical procedures (soft-tissue biopsies/excisions, soft-tissue grafting, pre-prosthetic bone contouring, or dental implant placement).
3. Minimum clinical follow-up of 6 months post-procedure.

Exclusion criteria included:

1. Active oncologic resections or major microvascular free flap reconstructions.
2. Concurrent systemic autoimmune diseases (e.g., pemphigus vulgaris, systemic lupus erythematosus).
3. Long-term systemic immunosuppressive therapy for non-dermatological indications.
4. Active oral infection or tobacco smoking > 10 cigarettes/day.

Exposure and Perioperative Protocol

Patients were divided into two operational cohorts based on perioperative management:

- **Optimized Cohort (n = 80):** Received a structured perioperative immunomodulatory protocol consisting of topical high-potency corticosteroid therapy (Clobetasol propionate

0.05% gel applied 3 times daily via custom splint or applicator for 14 days preoperatively). For patients with active erosive disease, a short course of oral Prednisone (0.5 { mg/kg/day} for 5 days pre-op, tapered over 7 days post-op) was co-administered. Surgery was performed only after clinical transition to a quiescent/reticular state.

- **Non-Optimized Cohort (n = 72):** Patients who proceeded directly to surgical intervention without a formal pre-procedural medical optimization phase or structured perioperative corticosteroid regimen (typically managed with standard postoperative analgesia and chlorhexidine rinses alone).

Study Endpoints & Definitions

- **Primary Outcomes:**

1. **Incidence of Köbner Phenomenon:** Defined as the new emergence of erythematous, ulcerative, or bullous lesions along or directly adjacent to the surgical suture lines within 30 days postoperatively.
2. **Mucosal Re-Epithelialization Time:** Defined as the number of post-procedural days required to achieve complete mucosal coverage without open ulceration or fibrin-covered wound beds, evaluated at standardized postoperative visits (Days 3, 7, 14, 21, and 30).

- **Secondary Outcomes:**

1. Surgical site dehiscence rate at 14 days.
2. Severe postoperative pain reported on a Visual Analog Scale (VAS 7/10) at Day 3.
3. 1-year dental implant survival (in the subset undergoing implant surgery).

Statistical Analysis

Statistical analysis was conducted using SPSS version 27.0. Continuous variables were compared using Student's t -test or Mann-Whitney U test according to distribution. Categorical variables were evaluated using Chi-square or Fisher's exact tests. Multivariable logistic regression was executed to identify independent risk factors for postoperative Köbnerization, controlling for age, gender, OLP clinical subtype, surgical procedure type, flap design, and perioperative optimization status. p -values < 0.05 were considered statistically significant.

Results

Table 1: Baseline Demographic, Clinical, and Surgical Characteristics of the Single-Center Cohort

Parameter	Overall Cohort (N=152)	Optimized Cohort (n=80)	Non-Optimized Cohort (n=72)	p-value
Age (Years ± SD)	53.6 ± 9.1	53.1 ± 8.8	54.2 ± 9.5	0.463
Gender (Female / Male %)	100 / 52 (65.8% / 34.2%)	53 / 27 (66.3% / 33.7%)	47 / 25 (65.3% / 34.7%)	0.901
OLP Clinical Subtype (%)				0.864
• Reticular / Plaque	65 (42.8%)	35 (43.8%)	30 (41.7%)	
• Atrophic / Erythematous	51 (33.5%)	26 (32.5%)	25 (34.7%)	
• Erosive / Ulcerative	36 (23.7%)	19 (23.8%)	17 (23.6%)	
Surgical Procedure Type (%)				0.925
• Dental Implant Placement	64 (42.1%)	34 (42.5%)	30 (41.7%)	
• Soft-Tissue Excision / Biopsy	45 (29.6%)	23 (28.8%)	22 (30.6%)	
• Pre-Prosthetic / Soft-Tissue Grafting	43 (28.3%)	23 (28.8%)	20 (27.8%)	

Parameter	Overall Cohort (N=152)	Optimized Cohort (n=80)	Non-Optimized Cohort (n=72)	p-value
Surgical Flap Design (%)				0.681
• Full-Thickness Mucoperiosteal Flap	115 (75.7%)	62 (77.5%)	53 (73.6%)	
• Split-Thickness Flap	37 (24.3%)	18 (22.5%)	19 (26.4%)	

Note: Demographics, baseline OLP disease subtypes, and surgical characteristics were evenly distributed across both cohorts within our single institution.

Table 2: Primary and Secondary Postoperative Outcomes

Outcome Measure	Optimized Cohort (n=80)	Non-Optimized Cohort (n=72)	Risk Difference / Effect Size	p-value
Primary Outcomes				
Köbner Phenomenon Incidence (%)	**6 (7.5%)**	**22 (30.6%)**	**-23.1% (95% CI: -35.2% to -11.0%)**	**< 0.001**
Re-Epithelialization Time (Days ± SD)	**11.2 ± 2.6**	**18.3 ± 4.2**	**-7.1 Days (95% CI: -8.2 to -6.0)**	**< 0.001**
Secondary Outcomes				

Outcome Measure	Optimized Cohort (n=80)	Non-Optimized Cohort (n=72)	Risk Difference / Effect Size	p-value
Surgical Site Dehiscence at Day 14 (%)	3 (3.8%)	12 (16.7%)	-12.9% (95% CI: -22.6% to -3.2%)	0.008
Severe Pain at Day 3 (VAS Score 7)	7 (8.8%)	21 (29.2%)	-20.4% (95% CI: -32.5% to -8.3%)	0.001
Postoperative Fungal Infection (Candidiasis)	6 (7.5%)	2 (2.8%)	+4.7% (95% CI: -2.1% to +11.5%)	0.281
1-Year Dental Implant Success Rate (n = 64)*	**33 / 34 (97.1%)**	**25 / 30 (83.3%)**	**+13.8% (95% CI: -0.7% to +28.3%)**	**0.068**

*Note: Evaluated only in the subgroup of patients undergoing dental implant placement (n = 64).

Table 3: Multivariable Logistic Regression Analysis of Predictors for Post-Surgical Köbner Phenomenon

Variable	Unadjusted OR (95% CI)	Adjusted OR (aOR) (95% CI)*	p-value
Non-Optimized Perioperative Status	5.43 (2.03–14.52)	4.95 (1.98–12.38)	< 0.001

Variable	Unadjusted OR (95% CI)	Adjusted OR (aOR) (95% CI)*	p-value
Baseline Erosive OLP Subtype	3.81 (1.56–9.30)	3.28 (1.32–8.15)	0.010
Split-Thickness Flap Elevation	2.98 (1.21–7.34)	2.74 (1.10–6.85)	0.031
Age 60 Years	1.38 (0.58–3.28)	1.21 (0.49–2.98)	0.678
Female Gender	1.15 (0.48–2.76)	1.02 (0.40–2.58)	0.965
Procedure Type: Grafting vs. Excision	1.78 (0.72–4.38)	1.48 (0.57–3.84)	0.418

*Note: Multivariable model adjusted for age, gender, baseline OLP subtype, procedure type, flap design, and perioperative optimization status.

Discussion

This single-center study evaluated the impact of structured perioperative immunomodulatory control on surgical wound healing outcomes in patients with oral lichen planus. The principal finding of this study is that pre-procedural optimization using high-potency topical and short-course systemic corticosteroids dramatically reduced the incidence of the Köbner phenomenon (7.5% vs. 30.6%) and shortened mucosal re-epithelialization times by over one week (11.2 vs. 18.3 days). Conducting this study within a single center eliminated inter-institutional variability in surgical protocols, operator technique, and histological diagnostic criteria.

The pathophysiological rationale behind these findings lies in suppressing T-cell activation prior to surgical incision. Mechanical injury during surgery triggers DAMP release, attracting autoreactive {CD8}^+ T-lymphocytes to the surgical wound margin [9]. In non-optimized patients with active subclinical inflammation, this secondary T-cell recruitment accentuates basal lamina destruction, resulting in Köbnerization and delayed wound closure [10, 11]. Preoperative corticosteroid administration effectively downregulates local {TNF-}\alpha and {IFN-}\gamma expression, preserving basement membrane matrix components required for rapid re-epithelialization [12, 13].

Surgical technique also played a significant role in outcomes. Split-thickness flap elevation was identified as an independent risk factor for Köbnerization (aOR: 2.74). Split-thickness dissection cuts directly through the subepithelial vascular network and basal zone, releasing cellular antigens and triggering localized inflammation. Full-

thickness mucoperiosteal flaps leave the delicate peri-mucosal architecture intact, mitigating the physical stimuli that drive Köbner flares [14, 15].

In the dental implant subgroup, patients managed with the optimized protocol exhibited higher 1-year implant success rates (97.1% vs. 83.3%). Peri-implant soft-tissue stability and tight junctional epithelial attachment are critical for protecting peri-implant marginal bone; localized OLP flare-ups around newly placed abutments increase soft-tissue dehiscence and early marginal bone loss [16–18].

Study limitations include its retrospective design, single-center framework (which may limit generalizability to non-tertiary care settings), and the evaluation of minor-to-moderate surgical interventions rather than major microvascular jaw reconstructions. Prospective randomized controlled trials are warranted to further refine perioperative dosing protocols.

Conclusion

Preoperative immunomodulatory optimization significantly reduces the incidence of the Köbner phenomenon, accelerates mucosal re-epithelialization, and decreases surgical site complications in patients with oral lichen planus undergoing oral and maxillofacial surgery. Clinicians should mandate disease quiescence and implement structured corticosteroid protocols prior to elective surgical interventions in this population.

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