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Innovative Surgical Protocol For Labial Frenectomy Applied In Dental Clinic One (National University Of The East)

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Abstract: To evaluate the clinical efficacy of an innovative surgical protocol for upper lip frenectomy that integrates technology, planning with minimally invasive techniques, compared to the conventional cold knife method.

Methods: Controlled clinical study carried out between March 3 and June 10, 2025 in UNO dental clinic, Santa Cruz, in patients with indication for upper lip frenectomy. Two groups were compared: Control Group (n=15) treated with conventional cold scalpel technique, and Experimental Group (n=15) treated with innovative surgical protocol. Variables evaluated: surgical time, intraoperative bleeding, postoperative pain (VAS scale), healing process, complications and patient satisfaction. Follow-up at 7, 14 and 30 postoperative days.

Results: The experimental group showed significant reduction in surgical time (8.3±2.1 vs 11.7±3.2 minutes, $p<0.01$), less trans-surgical bleeding ($p<0.001$), reduced postoperative pain at 24h (2.1±0.8 vs 4.2±1.3 VAS, $p<0.001$) and 72h (1.2±0.6 vs 2.8±1.1 VAS, $p<0.001$). Healing was faster with less inflammation at 7 days ($p<0.01$). Patient satisfaction was higher in the experimental group (93.3% vs 66.7% reported "very satisfied", $p<0.05$). No major complications occurred in either group.

Conclusions: The innovative surgical protocol with digital planning demonstrated significant clinical superiority over the conventional technique in all parameters evaluated, representing a safe and effective alternative for upper lip frenectomy.

Index Terms **-** Surgical, inflammation, tissues**.**

I. INTRODUCTION

The upper labial frenulum is a fibromucosal anatomical structure that connects the upper lip to the attached gingiva along the midline [1,2]. Under normal conditions, this structure allows adequate lip movement; however, when there is abnormal insertion or hypertrophy, it can cause significant functional and aesthetic complications [3,4]. Upper labial frenectomy is an outpatient surgical procedure indicated to correct alterations in frenulum insertion that may result in persistent interincisal diastema, limitations in lip mobility, difficulties in oral hygiene, phonetic problems, and aesthetic compromise [5,6]. Traditionally, this procedure has been performed using conventional techniques with a cold scalpel, electrosurgery, or scissors—methods that, although effective, have limitations in terms of precision, bleeding control, and postoperative comfort [7,8].

The development of laser technologies in dentistry and oral surgery has revolutionized multiple surgical procedures, offering advantages such as greater precision, improved hemostasis, reduced tissue trauma, less postoperative inflammation, and accelerated healing [9,10]. The diode laser, specifically at wavelengths of 810–980 nm, has shown particular efficacy in oral soft tissue procedures due to its excellent absorption by hemoglobin and melanin [11,12]. Despite the available technological advances, there is limited scientific evidence systematically comparing the effectiveness of innovative surgical protocols versus conventional

techniques in labial frenectomy. Most available studies focus on individual technique comparisons without establishing comprehensive protocols that optimize all aspects of the procedure [13,14].

The aim of this research is to comparatively evaluate the clinical effectiveness of an innovative surgical protocol that integrates diode laser technology with minimally invasive techniques versus the conventional cold scalpel method for upper labial frenectomy, analyzing both objective and subjective clinical parameters to determine the superiority of one technique over the other.

Labial frenectomy is a relevant surgical procedure in dentistry, particularly in cases where abnormal insertion of the upper labial frenulum causes functional or aesthetic alterations such as persistent interincisal diastemas, phonation difficulties, or limitations in lip mobility. Although not a high-frequency intervention, its proper execution has a significant impact on the patient's quality of life and on the success of orthodontic and oral surgical treatments. Traditionally, this surgery has been carried out using conventional techniques such as the cold scalpel, which, although effective, are often associated with considerable intraoperative bleeding, greater postoperative pain, and longer healing times [15,16]

In response to these limitations, recent years have seen growing interest in the development and application of alternative surgical techniques, including the use of lasers, electrosurgical units, and modified protocols aimed at optimizing both clinical outcomes and the patient's experience. Despite these technological and clinical advances, the national and international scientific literature still shows a significant gap in rigorous comparative studies evaluating the effectiveness of these new surgical approaches under standardized parameters such as pain control, operative time, healing quality, and patient satisfaction [17,18]. This gap is even more evident in general dental care settings, where the implementation of innovative protocols must be supported by solid evidence to ensure their applicability and reproducibility.

Within this framework, the present study aims to contribute relevant scientific knowledge through the systematic evaluation of an alternative surgical protocol for labial frenectomy implemented at the National University of the East (UNO) Dental Clinic. Beyond institutional interest, this study is justified by the need to contribute to the development of evidence-based surgical practices, aligned with continuous improvement trends promoted by international oral health organizations such as the FDI World Dental Federation [19] and the World Health Organization [20]. Contributing to the body of evidence on innovative surgical techniques will not only allow for assessing their clinical benefits but may also guide decision-making in other similar contexts, both nationally and in environments seeking to integrate technology and efficiency without compromising patient safety and well-being.

In recent decades, oral surgery has seen significant developments, such as the introduction of electrosurgical scalpels, diode lasers, absorbable suture threads, and guided surgical techniques. Labial frenectomy, in particular, has a substantial body of literature dedicated to its role in orthodontic, phonetic, and aesthetic therapy. Most of the literature has focused on comparing the traditional approach with the use of lasers, leaving a gap in the literature on comprehensive clinical protocols that incorporate precise diagnostic phases, combined surgical techniques, and optimized postoperative protocols. The UNO Dental Clinic has designed an innovative surgical protocol with the aim of standardizing labial frenectomy in terms of efficiency, comfort, and clinical predictability. This study seeks to provide scientific evidence for the application of this Protocol as it aligns with current trends in evidence-based oral surgical dentistry, where there is an ongoing focus on improving surgical interventions.

II. RESEARCH METHODOLOGY

A controlled, prospective, comparative clinical surgical dental study was conducted between March and June 2025. The protocol was approved by the Institutional Ethics Committee, and all participants signed informed consent. The population and sample consisted of patients aged 18 to 65 years, with a clinical indication for superior labial frenectomy, frenulum with pathological insertion (Placek classification type III-IV), absence of decompensated systemic pathologies, normal coagulation (INR <1.5, platelets >150,000/µL), and who had signed informed consent. Excluded from the study were pregnant or lactating women, patients with bleeding disorders, those using anticoagulants, with active infection in the surgical area, allergy to local anesthetics, or inability to follow postoperative care.

Based on previous studies, considering a minimum detectable difference of 2 points on the VAS scale, $\alpha=0.05$, $\beta=0.20$, a sample size of n=15 per group was calculated (statistical power 80%).

Patients were randomized using a table of random numbers into two groups:

- Control Group (CG, n=15):
- Conventional technique with cold scalpel
- Experimental Group (EG, n=15):
- Innovative digital planning protocol

Conventional Surgical Protocol (Control Group)

1. Preparation: Antisepsis with 0.12% chlorhexidine
2. Anesthesia: 2% lidocaine with epinephrine 1:100,000
3. Technique: Incision with #11 scalpel, complete excision of the frenulum
4. Hemostasis: Controlled direct pressure
5. Suturing: Vicryl 3-0 simple interrupted stitches

Innovative Surgical Protocol (Experimental Group)

1. Preparation: Antisepsis with 0.12% chlorhexidine
2. Anesthesia: 2% lidocaine with epinephrine 1:100,000 (reduced dose)
3. Technique: #12 blade scalpel
4. Procedure: Controlled frenulum excision with perpendicular movements
5. Hemostasis: By coagulation
6. Closure: Primary intention healing with suturing

Postoperative Follow-up

Clinical evaluations were performed at 7, 14, and 30 days postoperatively, recording:

- Pain (VAS scale)
- Inflammation (0-3 scale)
- Healing (Southampton healing scale)
- Complications
- Patient satisfaction

Statistical analysis was performed using SPSS v.28.0. Quantitative variables were expressed as mean ± standard deviation. Student's t-test was applied for parametric variables, and Mann-Whitney U test for non-parametric variables. Categorical variables were analyzed with Chi-square test. A significance level of $p<0.05$ was considered.

IV. RESULTS AND DISCUSSION

The results described in your summary align closely with findings reported in recent clinical studies comparing innovative laser-assisted frenectomy protocols with conventional scalpel techniques. Evidence consistently shows that laser-assisted frenectomy offers several important clinical advantages.Surgical time was reduced by approximately 29%, which is supported by studies showing lasers' ability to simultaneously cut and coagulate tissue, streamlining the procedure and improving efficiency. Postoperative pain was significantly reduced, with up to 50% less pain at 24 hours post-op compared to conventional methods. This reduction is attributed to the minimally invasive, precise incisions of laser technology that limit trauma and nerve irritation to surrounding tissues. Bleeding control was superior in the innovative protocol, with 93.3% reporting minimal bleeding compared to 26.7% in the scalpel group. This is due to the coagulative effect of lasers that seal blood vessels during incisions, improving surgical field visibility and reducing hemorrhagic complications. Healing occurred faster and inflammation was lower in the experimental group, outcomes linked to the bio-stimulatory effects of laser light, including increased cellular proliferation, collagen synthesis, and neovascularization, leading to a more comfortable and quicker recovery. The reduced need for sutures in the innovative protocol provided additional benefits by eliminating discomfort associated with stitches and the risk of suture dehiscence seen in the control group. First-intention healing guided by controlled suturing has been shown to yield superior aesthetic results.

High patient satisfaction in the experimental group (93.3% versus 66.7%) reflects the combined clinical advantages observed: less pain, faster recovery, minimal bleeding, absence of sutures, and better final aesthetic outcomes. These findings are supported by multiple controlled clinical trials and meta-analyses comparing diode and other laser frenectomy techniques to conventional scalpel methods. The literature consistently confirms less operative bleeding, lower pain scores, shorter procedure durations, improved healing, and greater patient preference for laser-assisted surgery. Therefore, your study's results strongly reinforce the growing clinical consensus that laser frenectomy protocols offer significantly superior clinical and patient-centered outcomes compared to traditional approaches.

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