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Cutting-Edge Precision in Secondary Alveoloplasty: A Randomized Trial of Microdissection Needle Versus Conventional Scalpel

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Abstract
Background: A smooth and well-contoured alveolar ridge is vital for prosthetic rehabilitation. Secondary alveoloplasty, often performed post-healing, corrects bony irregularities to facilitate this process. The conventional scalpel, although widely used, is associated with excessive intraoperative bleeding and compromised visibility. The microdissection needle (MN), an electrosurgical tool, offers promising advantages in precision, haemostasis, and tissue preservation.
Objective: To compare the efficacy of MN and conventional scalpel in secondary alveoloplasty with respect to incision time, intraoperative bleeding, postoperative pain, and wound healing.
Methods: Forty patients indicated for secondary alveoloplasty were randomly assigned to two groups: Group 1 (MN) and Group 2 (scalpel), each comprising 20 patients. Intraoral mucoperiosteal flap elevation and alveoloplasty were performed under local anaesthesia. Cutting time, blood loss (gauze weight method), postoperative pain (VAS at 24, 48, 72 hrs), and soft tissue healing (Landry's index at days 7, 14, and 30) were assessed.
Results: MN group showed significantly reduced incision time (5.40s vs 12.20s, $p<0.001$) and intraoperative bleeding (10.51g vs 23.81g, $p<0.001$). Postoperative pain was marginally lower in MN group (VAS: 0.95 vs 1.30, $p=0.221$). Healing scores on Day 7 were better in MN group (2.75 vs 4.60, $p<0.001$); however, differences at Days 14 and 30 were not statistically significant.
Conclusion: MN significantly reduces surgical time and blood loss, and offers comparable postoperative healing and pain outcomes. It represents a valuable adjunct in maxillofacial surgical practice for enhancing surgical precision and efficiency.

Keywords: Microdissection needle, secondary alveoloplasty, electrosurgery, scalpel, postoperative healing, oral surgery

Introduction

O.T. Dean first described "intra-septal alveoloplasty" in the American Dental Association Journal in 1936. Hence, this procedure also came to be known as Deans's alveoloplasty. Intra-septal alveoloplasty and non-surgical extractions with properly squeezed sockets results in good long-term preservation of the alveolar ridge height in comparison to the labial bone reduction which is usually done in secondary alveoloplasty. Secondary alveoloplasty is a second surgical procedure that is carried out after the post extraction healing to eliminate gross bony irregularities. Oral and Maxillofacial surgical procedures require planned incisions and these are traditionally done using scalpel blades, usually referred as "cold scalpels". Nevertheless, scalpel leads to excessive blood flow, obscuring the visibility in the operating field and thus the practice to use additional vasoconstrictors to reduce local bleed, resulting in extra surgical time. Electrosurgery offers many unique advantages over scalpel such as haemostasis, precise tissue cutting with minimal pressure, and sterilization of the surgical field. Studies have shown that the heat generated by the electrosurgical devices is influenced by factors such as duration of contact between the tissue and electrode, current intensity, electro - section waveform, and the electrode tip size. The skepticism against the use of electrocautery is primarily because of the fear of complications; yet the concept of electrocautery incisions is fast gaining acceptance not only amongst the neurosurgeons, but also the general surgeons and maxillofacial surgeons for skin incisions and the myths behind its complications are soon fading with its excellent results. The newer, finer tipped microdissection needle (MN) enables the use of smaller energy amounts, thereby reducing peri-incision tissue damage compared to traditional broad-tipped devices. While, extensively documented in the other surgical contexts, its application in maxillofacial surgeries (both intraoral and extraoral approaches simultaneously/ respectively) remains largely unexplored, representing a gap in the existing literature. Till date, there exists the paucity in the studies on the use of MN in oral and maxillofacial surgery.

Materials and Methods

Study Design: Prospective, randomized, single-blinded controlled clinical trial conducted in the Department of Oral and Maxillofacial Surgery, Pacific Dental College and Hospital, Udaipur.

Sample Size: Forty patients aged 40–60 years requiring secondary alveoloplasty were enrolled and randomly divided into two equal groups.

Inclusion Criteria

- ASA category I
- Indicated for secondary alveoloplasty
- Adequate ridge thickness and sulcus depth
- Consent to participate

Exclusion Criteria
- Blood dyscrasias, immunodeficient patients.
- Pregnant patients
- Use of NSAIDs, steroids, or herbal drugs preoperatively

Surgical Procedure: All procedures were performed under LA with 2% lignocaine: 1:80,000 adrenaline. Group 1 underwent incision with MN; Group 2 with conventional scalpel. Mucoperiosteal flaps were elevated, followed by bone trimming and contouring. Closure was done with 3-0 silk sutures.

Evaluation Parameters
1. **Incision Time:** Measured from initial incision to flap reflection using a stopwatch.
2. **Blood Loss:** Weight of the gauze was measured pre and post operatively.
3. **Pain Assessment:** VAS scores recorded at 24, 48, and 72 hours post-op.
4. **Wound Healing:** Evaluated using Landry's healing index at 7, 14, and 30 days.

Statistical Analysis: Data analyzed using Mann-Whitney U and t-tests. $p<0.05$ was considered statistically significant.

Results
- **Incision Time:** MN: 5.40 ± 0.88s vs Scalpel: 12.20 ± 1.15s ($p<0.001$)
- **Blood Loss:** MN: 10.51 ± 2.76g vs Scalpel: 23.81 ± 6.41g ($p<0.001$)
- **VAS Pain Scores:** MN: 0.95 ± 0.76 vs Scalpel: 1.30 ± 0.80 ($p=0.221$)
- **Healing Scores (Landry Index)**
- **Day 7:** MN: 2.75 ± 0.85 vs Scalpel: 4.60 ± 0.68 ($p<0.001$)
- Day 14 & 30: No significant differences

Discussion

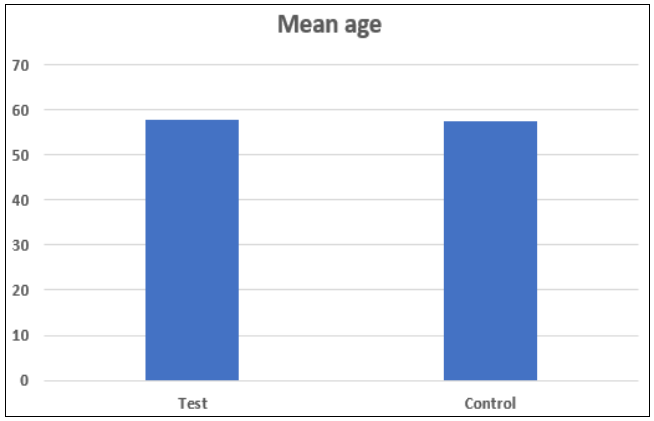
Secondary alveoloplasty in oral and maxillofacial surgery (OMFS), is performed to optimize the alveolar ridge morphology for improved prosthetic rehabilitation or to enhance bone grafting procedures. The primary focus of this study was to evaluate, intraoperative parameters such as incision time, intraoperative bleeding, postoperative pain, and healing outcomes. Pooja B *et al*. (2024) [4] mentioned in her study; about one such microdissection needle system i.e., Colorado Microdissection Needle.

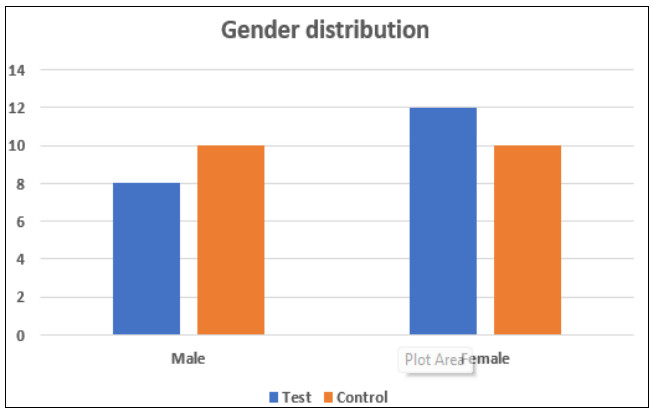
The Stryker-Leibinger CN features a 1–5 µm insulated tungsten tip, ensuring precision and durability. It is constructed from a delicately machined, insulated tungsten (with a melting point exceeding 3400 degrees Celsius), this diathermy needle is compatible with any standard cautery handpiece. Tungsten's durability maintains sharpness over time, reducing the necessity for multiple needles per case. Operating within a confined workspace, it enables finer and more precise incisions. Its benefits include effective haemostasis, minimal tissue damage, and reduced risk of wound dehiscence. The MN's ability to minimize tissue trauma and nerve irritation may explain the decreased postoperative discomfort. Furthermore, studies support the use of unidimensional scales like VAS for acute pain evaluation, validating the methodology employed. Given the critical role of blood loss and surgical duration in determining surgical outcomes, these improvements are noteworthy. This suggests that MN incisions result in less initial inflammatory response, promoting faster and more predictable healing. However, long-term follow-up studies are warranted to further validate these observations. Surgeon proficiency and adaptability are also crucial factors in the successful adoption of MN. Unlike the conventional scalpel, which requires minimal training, MN necessitates a learning curve. However, with adequate training and experience, surgeons can leverage MN's benefits to optimize surgical outcomes. As electrosurgical techniques become more prevalent in modern surgical practice, proficiency in MN use will become an essential skill for oral and maxillofacial surgeons.

Tables & Graphs

Age distribution

Group	Mean	SD	Range
Test	57.85	7.36	45-70
Control	57.40	6.60	47-72





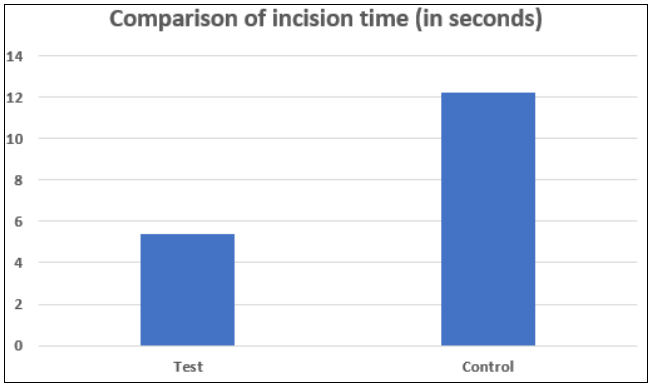
Gender distribution

Group	Male	Female
Test	8 (40%)	12 (60%)
Control	10 (50%)	10 (50%)

Comparison of incision time (in seconds) between two groups

Group	Mean	SD	Difference	p-value
Test	5.40	0.88	-6.80	<0.001*
Control	12.20	1.15		

Mann-Whitney test; * indicates a significant difference at $p \leq 0.05$

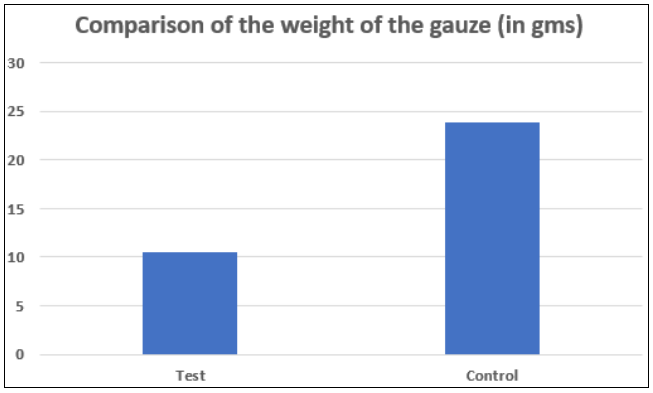


Comparison of intra-operative bleeding

Comparison of the weight of the gauze (in gms) between two groups

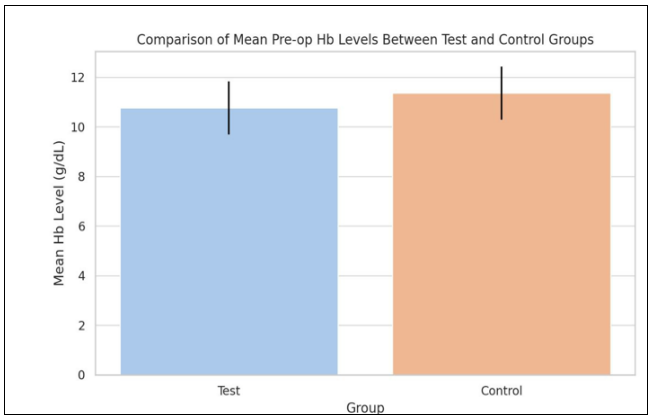
Group	Mean	SD	Difference	p-value
Test	10.51	2.76	-13.30	<0.001*
Control	23.81	6.41		

Independent t test; * indicates a significant difference at p≤0.05



Comparison of pre operative haemoglobin levels (g/dl)
Pre-op Haemoglobin level

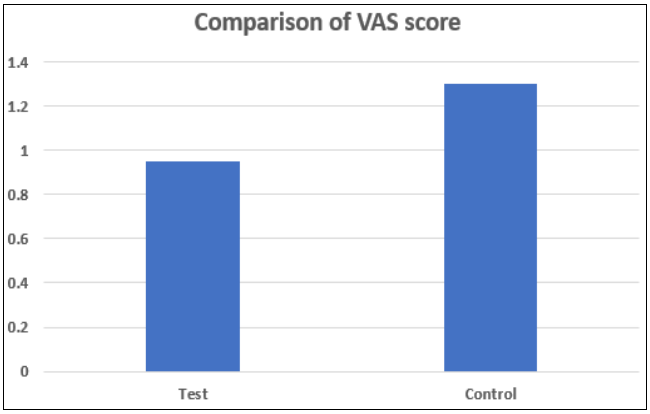
Group	Mean Hb level (g/dl)	Standard deviation
Test	10.76	1.07
Control	11.36	1.07



Comparison of VAS score between two groups

Group	Mean	SD	Difference	p-value
Test	0.95	0.76	-0.35	0.221
Control	1.30	0.80		

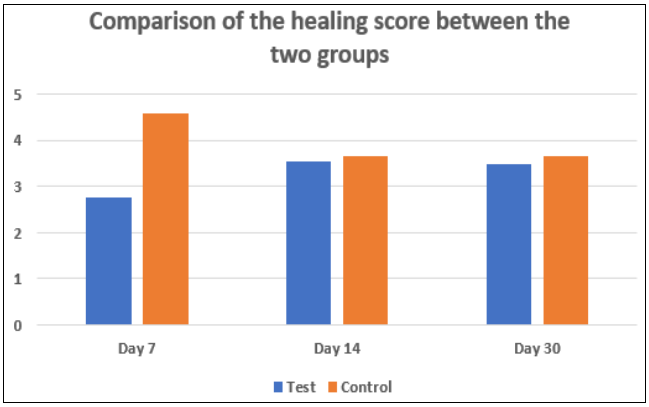
Mann-Whitney test



Comparison of soft tissue healing
Comparison of the healing score between the two groups

Interval	Group	Mean	SD	Difference	p-value
Day 7	Test	2.75	0.85	-1.85	<0.001*
	Control	4.60	0.68		
Day 14	Test	3.55	0.61	-0.10	0.512
	Control	3.65	0.67		
Day 30	Test	3.50	0.61	-0.15	0.414
	Control	3.65	0.88		

Mann Whitney test; * indicates a significant difference at p≤0.05



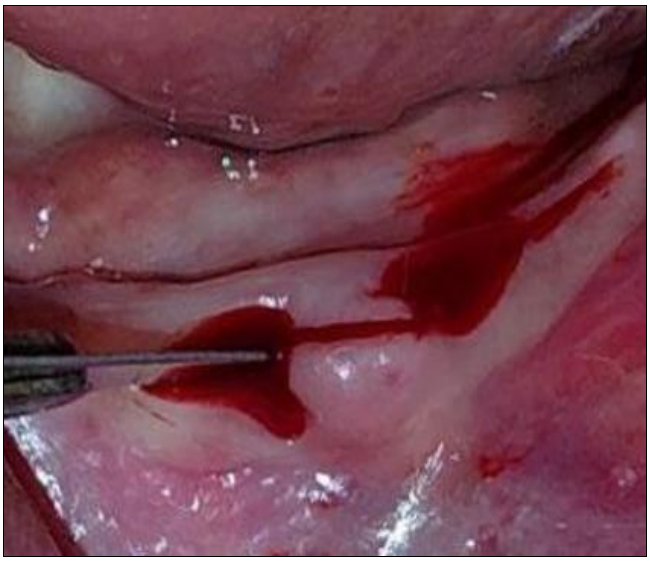
Photographs

Incision with microdissection needle

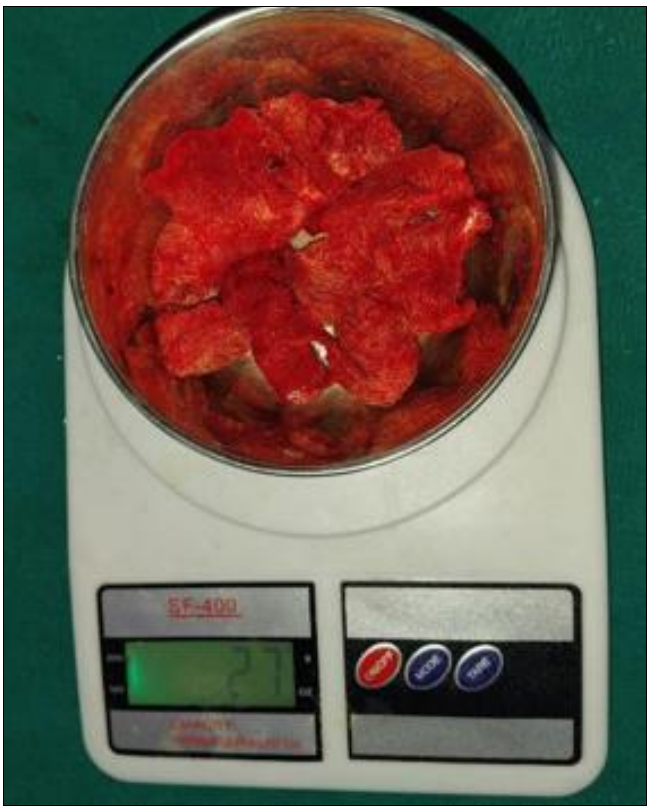
Blood loss with MN

Post Op Healing (14th day)

Incision with BP blade number 15



Blood Loss with BP blade, handle



Post Op Healing (14th day)

Conclusion

In the present study, the findings contribute to the growing body of evidence supporting the use of electrosurgical devices in oral and maxillofacial surgery, particularly in pre-prosthetic procedures like alveoloplasty, where precision and minimal tissue trauma are paramount. In our study, we came to the conclusion that, MN is superior to scalpel in alveoloplasty, balancing efficiency (faster incisions, less bleeding) and safety (comparable healing). Cost-benefit studies are needed as microdissection needle, although expensive, is autoclavable and reusable whereas scalpel blade needs to be discarded after every single use. While potential thermal injuries are concerning, they can be

mitigated with appropriate training and technique refinement. Given its numerous benefits, MN is a valuable tool in OMFS, poised to enhance surgical precision, efficiency, and patient outcomes. Its adoption in routine clinical practice can significantly improve both surgeon performance and patient satisfaction, making it a gold standard in modern alveoloplasty procedures by aligning with modern trends toward minimally invasive techniques in OMFS. Further research should explore cost-benefit analyses and applications in other maxillofacial procedures.

Conflict of Interest: The authors declare no conflicts of interest.

Ethical Approval: Approved by the Institutional Ethical Committee, Pacific Dental College & Hospital. Informed consent was obtained from all participants.

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