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Comparative Evaluation of the Efficacy of Diode and NDYAG Laser Assisted Biopsies with Conventional Scalpel Biopsy Procedures: An Original Research

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ABSTRACT

Background: Various biopsy techniques are conventionally used with each technique having its own pros and cons. A study was carried out to compare scalpelversusdiodelaser for biopsyofor allesions under various parameters vital to histopathological diagnosis.

Materials and Methods: A total of 40 patients (20 in each group)satisfyingtheinclusioncriteriawererandomlyallocated using odd-even scheme into scalpel and laser groups by a blindedoperator.Thepatientswereevaluatedintra-operatively forpatientcomfort,bleeding,timetakenforexcision,andpost- operatively for pain and healing. The excised samples were sent for histopathological analysis as follows: Loss of architecture in epithelium, loss of architecture in connective tissue, charring, andartifacts.

Results: The mean time taken for excision was statistically similar in both the groups. Distribution of patient comfort and painwasstatisticallynotsignificant.Healingwasuneventfulin boththegroups.Inthehistologicalparameters,therewasloss ofarchitectureinepitheliumin75%ofcasesinthelasergroup. In the same group, there was loss of architecture in 85% of thesamples,andtherewascharringin85%ofthespecimens.

Conclusion: Both techniques seem to be equally effective in performing excisional biopsies of oral lesions. Laser has the advantage of maintaining a bloodless field and avoidance of suturing as well. However, due to the associated thermaldamagecaused,theremaybeminorlossofhistologicalarchitecture.

Keywords: Excisional biopsy, Histopathology, Laser biopsy, Scalpel biopsy.

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INTRODUCTION

Biopsy is one of the most vital procedures in the diagnosis and treatment planning for any surgical specialty.[1] Various biopsy techniques used in excisionoforallesionsarescalpelbiopsy,punchbiopsy, electrosurgery, and laser biopsy. The humble scalpel is still routinely employed because of economy, ease of use, accuracy, and minimal damage to adjacent tissues. However, it does not provide good hemostasis, which is critical when operating on highly vascular tissues or other lesions of the maxillofacialregion.It is crucial that the entire biopsy specimen be intact to make an unequivocal histological diagnosis. Hence, any surgical device that creates thermal or mechanical damage in the tissue to be examined is not recommended for performing biopsies. Due to these potential problems, the feasibility of routinely carrying out laser biopsies has been debatable. Recently, there have been reports of injection laser or diode laser, as a surgical aid to soft tissue surgery in the maxillofacial region. The advantages of diode lasers are minimal post-operative swelling and scarring, decreased post-operative pain, and maintaining bloodless field.[2] A study was carried out at a postgraduate dental institution to compare the efficacyofdiode and NdYAG laserandscalpel,toperform oral biopsies, using an array of clinical and histological parameters.

MATERIALS AND METHODS

We conducted the study with the aim to compare the efficacy of diode and NdYAG versus scalpel as a surgical aid in performing biopsy of oral lesions, to evaluate the healing process after scalpel and laser biopsy, to evaluate patient comfort following laser and scalpel surgery, and to analyze the histological parameters of the specimen obtained with each of these techniques.Patients presenting with benign intraoral lesions requiringbiopsywereselectedforthestudy.Appropriate clearance for carrying out the study was obtained prior fromtheinstitutionalethicscommittee.Atotalof40subjects(20ineachgroup)satisfyingthe inclusion criteria were included in the study and randomlyallocatedusinganodd-evenschemebyablinded operator into scalpel and laser groups. Group I included biopsy taken from oral lesions with scalpel. Group II included biopsy taken from oral lesions with diode and/ NdYAG laser. Twenty patients underwent biopsy using scalpel and sutures were placed. In 20patients,excisionofthelesionwasdonewith970nm diode / NdYag laser. For all the lesions biopsied, a 0.5 mm of safety margin was considered in both thegroups.Efficacy of the technique was evaluated by visual assessment of intraoperative bleeding in both the groups and recording of time taken. Post-operative patient comfort was also recorded. Pain assessment was done after 24 h using a visual analog scale (VAS). Healing was assessed after 1 week. The excised samples were sent for histopathological analysis and various parameters such as loss of architecture in epithelium, loss of architecture in connective tissue, charring, and presence of artifacts were recorded**.** The data collected were tabulated and statistically analyzed. Keeping the $p<0.05$ as significant the appropriate statistical tools were used to compare the observations.

RESULTS

Clinical features

Intraoperative parameters [Figure 1]:

1. Patient comfort - In Group I, 40% of patients had a VAS score of 2, 40% of patients with VAS score of 3, 15 % of patients with VAS score of 4, and 5% with VAS score of 1. In Group II, 55% of patients had a VAS score of 2, 30% of patients had VAS score of 3, 15% of patients with VAS score of 3, and none had score 1 (P =0.759)
2. Incidence of bleeding - 100% of patients in Group I

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hadbleedingduringtheprocedure,whereasnoneof the patients had bleeding in Group II (P <0.001)

3. Time taken - In Group I, time taken for the procedure in 55% of patients ranged from 6 to 11 min, in 30%ofpatientstimetakenrangedfrom11to15min, in 10% of patients ranged from 1 to 5 min, and in 5% of patients ranged from 16 to 20 min. The mean timetakeninGroupIwas9.15min.InGroupII,time taken for the procedure in 60% of patients ranged from 6 to 10 min, in 15% of patients ranged from 11 to 15 min, in 15% from 1 to 5 min, and in 10% from 16 to 20 min. The mean time taken in Group II was 9.30 min (P =0.900).

Post-operative parameters [Table 1]:

1. Pain - After 1 day, in Group I, 45% of the patients hadaVASforpainof2,40%hadpainscoreof3,10% hadpainscoreof4,and5%hadpainscoreof1.After 1 day, in Group II, 55% of patients had a pain score of3,35%hadapainscoreof2,10%hadpainscoreof 4, and none had pain score of 1 (P =0.805)
2. Healing - Healing was uneventful after 1 week in all the 40 patients (P =1.000).

Histopathological parameters [Figure 2]:

1. Epithelium - In Group I, there was no distortion of epitheliuminanyofthespecimen.InGroupII,there was loss of architecture in the epithelium in 75% of the specimens (P <0.001)
2. Connective tissue - In Group I, there was no distortion of connective tissue in any of the specimens. In Group II, there was loss of architecture in the connective tissue in 85% of the specimens (P <0.001)
3. Charring - In Group I, there was no charring in any of the specimens. In Group II, there was charring in 85% of the specimens (P <0.001)
4. Artifacts - In Group I, artifacts were present in 20% of the specimens. In Group II, artifacts were present in 10% of the specimens (P =0.376).

TABLE 1: POST-OPERATIVE PARAMETERS IN THE TWOGROUPSSTUDIED

Post- operative parameters	Group I (n=20) (%)	Group II (n=20) (%)	Pvalue
Pain			
1	1 (5)	0 (0)	0.805
2	9 (45)	7 (35)	
3	8 (40)	11 (55)	
4	2 (10)	2 (10)	
Healing			
Uneventful	20 (100)	20 (100)	1.000
Eventful	0 (0)	0 (0)	

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FIGURE 1: (A) DISTRIBUTION OF PATIENT COMFORT IN THE TWO GROUPS STUDIED, (B) BLEEDING IN THE TWO GROUPS STUDIED, (C) TIME TAKEN IN THE TWO GROUPS STUDIED.

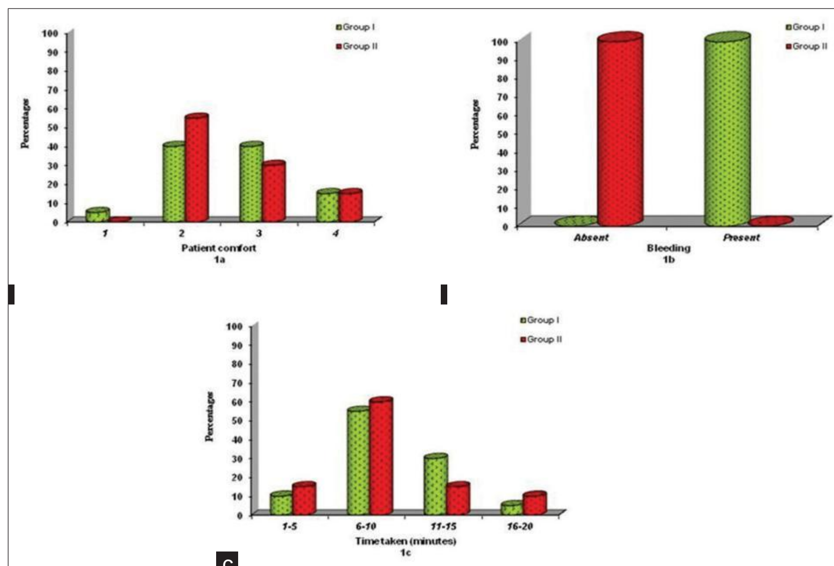

FIGURE 2: (A) HISTOLOGICAL LOSS OF ARCHITECTURE IN EPITHELIUM, (B) HISTOLOGICAL LOSS OF ARCHITECTURE IN CONNECTIVE TISSUE, (C) DEGREE OF CHAR- RING, (D) HISTOLOGICAL ARTIFACTS IN THE TWO GROUPS STUDIED.

DISCUSSION

A comparative study of carrying out excisional biopsy of oral lesions using scalpel versus diode and NdYAG laser was done on 40 patients. Patient comfort was measured using visual analog scale. There was no statistical difference in the intraoperative discomfort in both groups. Yet, patients in the scalpel group complained a sense of pricking during suturing. Post-operative discomfort was less in laser as compared to conventional surgical

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procedures[3] which is also similar to findings reported in a study by Dhabekar et al., in2010.[4] Bleeding was observed only in scalpel group. Diode laser has an excellent cutting and coagulation ability with a tolerable damage zone, and hence, there is no post-operative bleeding.[5] Diode laser has also been reported to be more effective than conventionalsurgery in the reduction of intraoperative bleeding andpost-operative pain.[6-9]The experience in pain in the two groups was statistically insignificant with P = 0.805. Although the mechanism of analgesic effects of laser therapy is not well understood, an increased pain threshold through thealterationofneuronalstimulationandfiringpattern, and the inhibition of the medullary reflexes is thought to be involved.[10-11] In a previous study by Baiju et al. comparing laser and scalpel biopsies, pain observed at the laser treated site as per VAS scale after 24 h was minimal compared to moderate pain in the scalpel-treated group. The same was noted in our study. This can be attributed to the fact that the cellular disintegration caused at the impact site does not allow for the release of inflammatory mediators which causes minimal or no pain in laser wounds.[12]Postoperatively, the healing process wasmonitored based on clinical signs and symptoms. There were no signs of any infection and wound dehiscence in any of the cases. Healing was uneventful in all the cases with P = 1.000. The newly formed epithelium in laser biopsy specimens is seen to be more thin and parakeratoticinnaturewhencomparedwiththeepithelium formed after scalpel excision. Post-laser wounds showappreciablylesserquantityofmyofibroblasts.This results clinically in lesser degree of wound contraction and scarring and shows improved post-operative function, especially in critical areas of the tongue, floor of the mouth, soft palate, and buccal mucosa.[11] The only drawback is that healing occurs at a slower pace which needs to be explained to the patient. Laser woundsthus may heal completely after 2 or 3 weeks whencompared to scalpel wounds, which generally heal in a week to 10days.[13]Theactionofmost dental lasers occurs throughphotonicabsorption whichresultsinincreasedtemperature(oftenbymorethan100°C)withinthetissuebeingfocusedonbythelaser beam. With this aim in mind, aneffortwasmadetoanalyzethethermaleffects,particularlyatthemarginal areas of the excised specimen inourstudy.[14]Adetailedsearchoftheliteratureshowedthatdiodelaser often caused significant tissue damage suchastissuenecrosisandsloughingandcharringofthetissuemargin.However,inourstudy,sincetheexcisionwasdoneusingrelativelylowpowersetting(2.0W,810nm),thetissuesectionsexcisedbydiodelaser,showedlimited degree of thermal effects at the marginsofthelesion, epithelium, and underlyingconnectivetissue.Instead,coagulationeffectswereseeninspecificareasat the margins, related to epitheliumandconnective tissue. Despite this, there was no hindranceincarrying outhistologicaldiagnosisofthelesions.Itiscriticaltonote, however, that in the case of neoplasticordysplasticlesionseventhesethermaleffects,atthemarginsmay causedifficultiesindeterminingtheextentoflesionaswellassubsequentdiagnosis.Hence,itisrecommendedtokeeptheincisionslightlybeyondthemarginsofthe suspected lesions so that the pathologist is totally free from uncertainty and does not misinterpret the histological picture.[14]The histological picture of the epithelium was normal in all the samples of Group I, whereas there was some degree of loss of architecture in 15 samples in Group II. This may be as a result of thermal effects of the laser beam. This loss of architecture in epithelium was statistically significant with $P < 0.001$. There is no discernable epidermal destruction in histopathologic specimens following scalpel biopsy.[15-16]The loss of architecture in connective tissue was statistically significant with $P < 0.001$. Pogrel in his study of 23 excisionalbiopsiesnotedthatthegreatestdegreeofthermal effects was seen in dense connective tissue andmucosal epithelium with a lesser amount in loose connective tissue.[17]Charring was understandably absent in all cases of Group I but was present in 17 samples of Group II which was statistically significant value ($P < 0.001$). The singular artifact seen subsequent to

laser biopsies is the presence of marginal charring of tissue; however, as long as an adequate depth was maintained; this did not hamper the diagnosis.[4] In the event of excessively fibrotic lesions which are difficult to excise and need higher power settings, the entire marginal region may show significant charring.[18] This was also the experi- ence in our study as well.Artifacts were present in four samples of Group I and in two samples of Group II with $P < 0.376$. Laser biopsies result in relatively lesser need of handling of tissue when compared to scalpelexcisions.Thisreducesthechancesofproducing artifacts within the specimen and subsequent betterhistopathologicaldiagnosis.[1]

CONCLUSION

It appears that either technique seems to be equally effective in carrying out excisional biopsies of benign oral lesions under the study parameters. Further studies with larger sample size may be carried out in future to corroborate these results.

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