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Research Article

SURGICO-THERAPEUTIC MANAGEMENT OF ORAL TUMOURS IN DOGS WITH REFERENCE TO DIODE LASER

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ABSTRACT

The study included 15 dogs presented with histologically different oral tumours and was conducted in order to evaluate efficacy of diode laser for excision of oral tumours. All the tumours were surgically excised using 980 nm diode laser under general anaesthesia. This was followed by chemotherapy using Carboplatin @ 300 mg/m^2 at 21 days interval in suitable dogs (n= 3) with confirmed malignancies. Complete surgical wound healing was observed at two weeks with minimum inflammation and cicatrization. Chemotherapy was discontinued after 4 cycles in all the 3 dogs either due to lack of response to treatment or high grade gastrointestinal toxicosis. Histopathology confirmed the following type of oral tumours; fibromatous epulis, acanthomatous ameloblastoma, malignant melanoma, fibrosarcoma, squamous cell carcinoma and osteoma. Local tumour recurrence was observed in about 50% of the dogs within 60 days of surgery. Laser excision of oral tumours is recommended in dogs as it minimizes intra-operative haemorrhage and thus improves the field of visibility during surgery.

Keywords: Dogs, Diode laser, Carboplatin, Chemotherapy, Histopathology, Oral tumor

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Oral neoplasms are the fourth most common type of neoplasms and constitute about 6% of the different types of neoplasms seen in dogs with near equal frequency for benign and malignant forms (Mathews, 2008). Common neoplasms of oral cavity include; epulis, acanthomatous ameloblastoma, viral papillomatosis, oral malignant melanoma, squamous cell carcinoma, fibrosarcoma, osteosarcoma, chondrosarcoma and mast cell tumour (Lascelles and Dobson, 2011).

Various modalities employed for treatment of oral neoplasms are surgical excision, chemotherapy, radiotherapy, immunotherapy, hyperthermia, cryosurgery and photodynamic therapy or in combination (Head *et al.*, 2002). The surgical excision may include mandibulectomy and maxillectomy, particularly when tumour invades bone (Mathews, 2008). Conventional method of surgical excision of oral tumour often results in excessive haemorrhage which may be overcome by the use of LASER. The recurrence of tumour has been reported to be delayed, following chemotherapy, and thus increasing the survival time (Brockley *et al.*, 2013). The commonly used drugs in therapy of oral tumours are Carboplatin, Cisplatin, 5-Fluorouracil, Paclitaxel, Docetaxel and Hydroxyurea. The present report describes the use and benefits of diode LASER when used for oral tumour excision and discusses use of Carboplatin in malignant tumours of oral cavity.

MATERIALS AND METHODS

A total of 15 dogs with 16 oral tumours were included in the study. The surgical excision of oral tumours was done using 980 nm GaAlAs diode LASER in continuous wave mode, between 15-20 watt power, under dissociative anaesthesia. Xylazine was used as sedative and administered at 1.1 mg/kg, via intramuscular route. Induction and maintenance was done by using Ketamine (5-10 mg/kg) and Diazepam (0.25-0.5 mg/kg) administered intravenously. Following induction, most dogs were intubated using an endotracheal tube, so as to prevent aspiration of fluids (blood, flushing solutions, etc). The tissue samples following excision were sent for histopath-ological examination. In cases of malignant tumours, chemotherapy was carried out in selected dogs based on clinical condition of dog and owner compliance. Treatment cycles were started at about 3-4 weeks following surgery, in selected patients.

Chemotherapy was carried out in 3 dogs, using Carboplatin @ 300 mg/m^2, administered slow IV in 5% NSS, at an interval of 21 days for 4 cycles. Antioxidant supplementation using Ocoxin liquid was advised @1ml/5kg body weight for atleast 60 days. Data regarding prevalence, complications following surgery, chemotherapy and tumour recurrence was recorded till 60 days following the start of therapy. Haemato-biochemical parameters were evaluated on days 0, 7 and 14 of surgery and on each cycle of chemotherapy. The collected data were statistically analyzed by using Two-way Factorial Completely Randomized Design as per the Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The study was conducted between December 2019 and January 2021 and incidence of oral tumours (n=18) was 1.03% of all surgical cases (n=1732) and 13.04% of all

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Table 1

Prevalence of oral tumours in dogs

Parameter		Number	Percentage
Age	Less than 8 years	4	26.67%
	More than 8 years	11	73.33%
Sex	Female	5	33.33%
	Male	10	66.67%
Breed	Non-Descript / mixed breed	6	40%
	Spitz	2	13.33%
	Labrador Retriever	2	13.33%
	Golden Retriever	1	6.67%
	German Shepherd Dog	1	6.67%
	Great Dane	1	6.67%
	Boxer	1	6.67%
	Rottweiler	1	6.67%
Tumour location	Gingiva	8	50%
	Palate	4	25%
	Buccal mucosa	3	18.75%
	Labial mucosa	1	6.25%
Tumour appearance	Ulcerative	10	62.5%
	Non-ulcerative	6	37.5%

tumours (n = 138) (Table 1). The mean age of the dogs presented with oral tumours was 10.43 years with a range of 6 to 15 years. Majority (73.33%) of the dogs presented with oral tumours were older than 8 years of age (Wingo 2018, Cray *et al*., 2020). Most of the dogs, presented with oral tumours were male (66.67%) and of a non-descript (40%) breed (Brockley *et al.*, 2013), which could also be attributed to such dogs being preferred as pets. The common location of oral tumours was the gingiva (Cray *et al.*, 2020) followed by the palate, buccal and labial mucosa.

The haemato-biochemical parameters showed no significant changes following surgical excision using diode LASER. The duration of surgery using LASER ranged from 7 to 39 minutes. The use of laser improved haemostasis, caused minimal blood loss, allowed access to remote parts of the mouth such as the soft palate and improved field of visibility (Derikvand *et al.*, 2016 and Igna *et al.*, 2016). Most of the dogs (93.33%) resumed feeding by the 3rd post-operative day. One dog was sustained on fluids till he started eating on 5th post-operative day. Wound healing following laser excision occurred with minimal inflammation, lesser pain and a decreased degree of cicatrization (De Lorenzi *et al.*, 2015). Complete wound healing occurred in most cases (86.67%) by the 15th post-operative day. In one case where sutures were placed for mucosal apposition, wound dehiscence was observed. However, the wound healed satisfactorily by secondary intention.

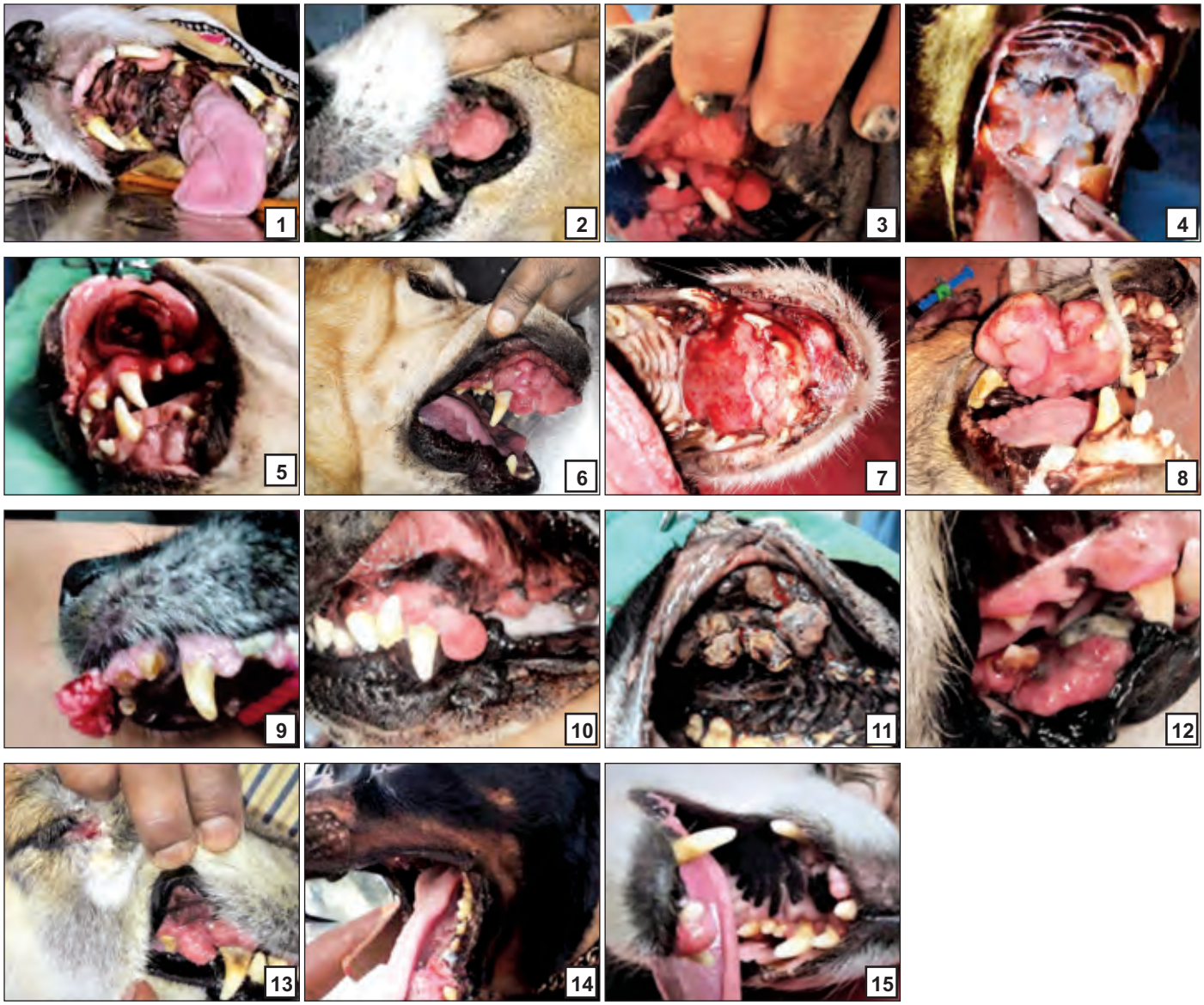
Histopathology revealed the following types of benign tumours: Fibromatous Epulis (25%), Acanthomatous Ameloblastoma (18.75%) and Osteoma (6.25%), while malignant neoplasms were Malignant Melanoma (18.75%), Fibrosarcoma (18.75%) and Squamous cell carcinoma (12.50%). Two dogs with malignant melanoma and 1 with squamous cell carcinoma were subjected to chemotherapy using Carboplatin. Following each cycle of chemotherapy, all the 3 dogs showed leukopenia, neutropenia, decreased haematocrit and thrombocytopenia. Biochemical alterations with mild increase in serum creatinine, SGOT, SGPT and SAP up to grade 1 and BUN upto grade 3, were also noted. Table 2 tabulates changes with respect to haemato-biochemical parameter based on mean calculated on various days across all 4 cycles. One dog showed grade 3 gastrointestinal toxicosis following second cycle, which was managed medically, however Carboplatin dose was reduced to 250 mg/m^2 for the

Table 2

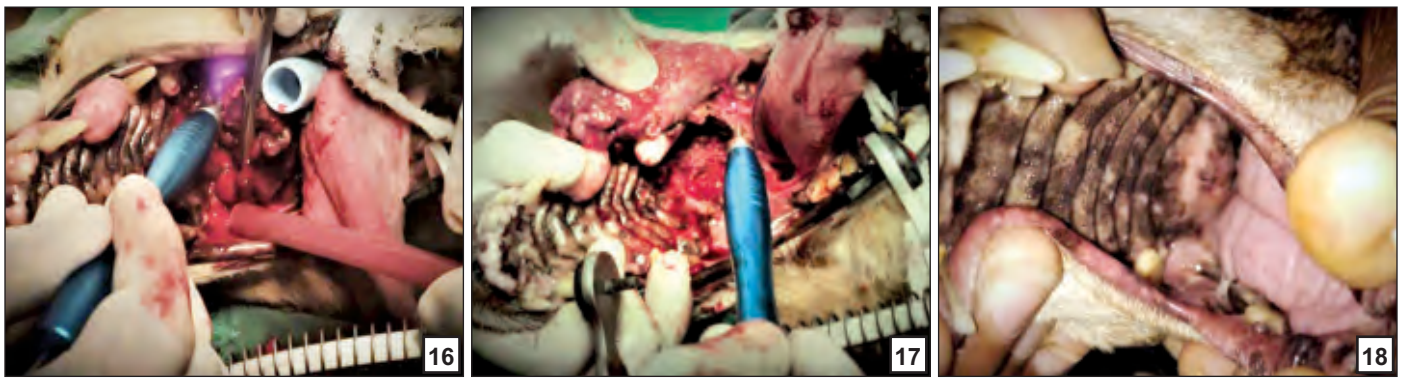
Haemato-biochemical changes recorded during Chemotherapy

Parameter	Units	Day 0	Day 7	Day 14
Haemoglobin	g/dL	12.85 ± 0.26^a	10.23 ± 0.27^b	10.88 ± 0.24^b
Packed Cell Volume	%	37.02 ± 0.50^a	31.73 ± 0.51^c	34.58 ± 0.63^b
Total Leukocyte Count	x10^3/cumm	14.44 ± 0.44^a	12.18 ± 0.46^b	10.48 ± 0.33^c
Neutrophils	%	73.13 ± 0.71^a	66.84 ± 0.70^b	64.15 ± 1.20^c
Platelet count	X10^5/cumm	2.58 ± 0.12^a	2.07 ± 0.09^b	1.53 ± 0.06^c
Serum Creatinine	mg/dL	1.11 ± 0.05^c	1.63 ± 0.06^a	1.31 ± 0.04^b
Blood Urea Nitrogen	mg/dL	26.33 ± 1.67^c	56.05 ± 2.81^a	34.43 ± 2.20^b
ALT	U/L	67.68 ± 5.55^c	121.71 ± 7.44^a	89.03 ± 2.13^b
AST	U/L	59.32 ± 5.43^c	106.24 ± 5.80^a	86.63 ± 2.29^b
Serum Alkaline Phosphatase	IU/L	195.31 ± 8.60^c	279.90 ± 8.19^a	239.95 ± 4.49^b

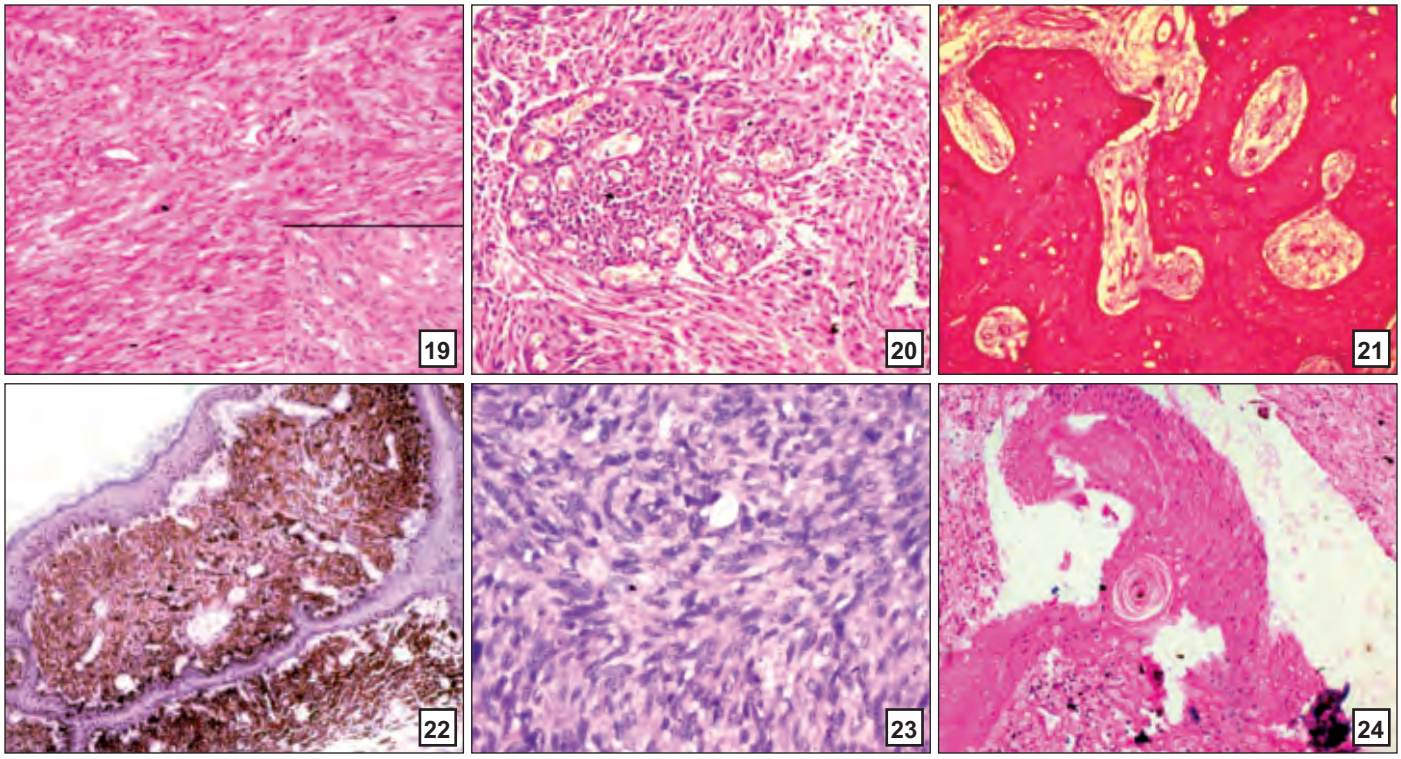
Different superscripts row-wise wise indicates significance



Figs. 1-15 : Tumour distribution based on type and location **(1)** Malignant Melanoma and Osteoma on soft palate and gingiva in a non-descript dog. **(2)** Closed view of Osteoma on gingival border. **(3)** Epulis in Boxer. **(4)** Fibrosarcoma on palate in a non-descript dog. **(5)** Fibrosarcoma on labial mucosa in a Labrador Retriever. **(6)** Acanthomatous Ameloblastoma involving maxilla in a Labrador Retriever. **(7)** Acanthomatous ameloblastoma involving the palate in a Spitz. **(8)** Fibrosarcoma involving the palate in a non descript dog. **(9)** Squamous cell carcinoma in ND dog, gingival border. **(10)** Epulis in a Great Dane. **(11)** Malignant melanoma, buccal mucosa, ND dog. **(12)** Squamous Cell Carcinoma on buccal mucosa in a Golden Retriever, **(13)** Epulis in a non-descript dog. **(14)** Mandibular Acanthomatous Ameloblastoma in a Rottweiler. **(15)** Epulis in Spit.



Figs. 16-18 : Laser Excision of Oral tumour- Surgical Procedure **(16)** Laser beam directed to surgical site via optical fibre, handled using handpiece. **(17)** Separation of tumour from soft palate. **(18)** Complete healing of surgical wound- day 15 post surgery



Figs. 19-24 : Histomorphology of oral tumours during the study **(19)** Fibromatous epulis (H&Ex10), Inset: H&Ex40. **(20)** Acanthomatous Ameloblastoma (H&Ex20). **(21)** Osteoma (H&Ex40). **(22)** Malignant Melanoma (H&Ex10). **(23)** Fibrosarcoma (H&E 40x). **(24)** Squamous cell carcinoma (H&E 40x)

Table 3

Tumour type and treatment outcomes

Tumour type	Number of Dogs	Percentage (%)	Treatment modality	Tumour recurrence (number of dogs)	Survival % in minimum 2 month follow up period
Epulis	4	25	Laser excision	0	4
Acanthomatous Ameloblastoma	3	18.75	Laser excision	3	1
Osteoma	1	6.25	Laser excision	0	N/A*
Malignant Melanoma	3	18.75	Laser excision + Chemotherapy	3	1
Fibrosarcoma	3	18.75	Laser excision + Chemotherapy	1	3
Squamous Cell Carcinoma	2	12.5	Laser excision + Chemotherapy	1	2

*The dog with Osteoma also had concurrent malignant melanoma, progression of which led to euthanasia of the dog.

subsequent cycles. Grades were decided based on VCOG-CTCAE (2004). Similar adverse events and toxicities were stated by Dank *et al.* (2014) and Woodruff *et al.* (2019).

Following chemotherapy, the dog with squamous cell carcinoma showed stable disease but severe GIT toxicosis, while the other 2 dogs with malignant melanoma showed disease progression. Because of the complications, chemotherapy was stopped following fourth cycle in all dogs. One dog with oral melanoma was euthanized before the end of the study period due to disease progression. The other two dogs were continued on Ocoxin liquid following chemotherapy.

Local tumour recurrence was noted in 8 dogs. All dogs with malignant melanoma (3), acanthomatous ameloblastoma (3) and one dog with squamous cell carcinoma and one dog with fibrosarcoma showed local tumour recurrence in a minimum follow up period of 2 months. Surgery reduced the discomfort and haemorrhages

from the tumour site till reocurence. There was minimal scar tissue formation following healing. Ease of surgery, decreased intra-operative haemorrhages and absence of other systemic effects proved LASER surgery to be a safe alternative for oral tumour resection in dogs.

The use of Carboplatin as an adjuvant therapy, along with antioxidant Ocoxin, proved to be beneficial in 2 cases where the life of patient was prolonged, while the animal was relatively comfortable throughout the study period. Treatment outcomes are included in Table 3. Out of 3 dogs with malignant melanoma, only 1 dog survived beyond the follow up period. The dog that was not subjected to chemotherapy, succumbed around 45th day post surgery. Tumour recurrence was observed in the dog with high grade squamous cell carcinoma and lymph node enlargement was noticed around 2 months following chemotherapy. However, the dog was apparently comfortable and continued normal activity, for months after the study period. The other dog with squamous cell carcinoma did not show any recurrence or progression, within study period.

The study concludes that using diode Laser is a safe alternative to conventional methods, for oral tumour excision. Relative ease of surgery due to accessibility to remote locations within the oral cavity, decreased intra operative haemorrhages and improved field of visualization make diode lasers a practical surgical modality. Further studies with more patients may need to be conducted to evaluate efficacy of Carboplatin as chemotherapeutic drug of choice for malignant oral tumours.

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