

**Original article:**

**Influence of marginal and segmental bony resection on the local control of oral Squamous cell carcinoma involving the mandible.**

*Mohammad Deedarul Alam*

**Abstract:**

**Background and objective:** Marginal or segmental resection of bone are often required for tumor removal in oral squamous cell carcinoma patients to secure adequate margin. The present study aims to evaluate the surgical outcome and post-operative complication of both group of patients and also assesses the local control of the disease in the oral cavity. **Methods:** In this prospective study, 32 patients who were treated with marginal or segmental jaw resection for oral squamous cell carcinoma of the lower part of oral cavity was undertaken within September 2008 to August 2013. There were 9 males and 23 females with a median age of 40.5 years. Twenty patients underwent marginal and 12 patients had segmental resection of the mandible. Distribution of the subject by age, sex, primary site of lesion, pathologic tumor stage, presence of mandibular invasion, pathologic cervical lymph node stage and feature of post-operative complications were analyzed prospectively. **Results:** According to this study, the mandible was involved in 83.3% of patient with segmental resection and 15% of patients with marginal resection. Buccal mucosa was mostly involved site in marginal group (60%) and retro molar trigon was highly involved site with segmental group (41.7%). In marginal group 30% cases was involved with stage1 and 70% was stage2; in segmental group 25% cases were stage2 and 67.7% were stage3. Statistically significant difference was exist in pathological cervical node stage( $p<0.05$ ). Mandibular invasion was significantly more in segmental group ( $p<0.05$ ). Soft tissue surgical margins were positive in 4 patients (20%) in the marginal group and in 3 patients (25%) in the segmental group. Negative neck lymph node was found in 20 (63%) cases and positive neck node was found in 12 (37%) cases, of which four patients, including 2(15%) cases in the marginal group and 2(8.3%) cases in the segmental group was died. Trismus and mastication problems were found higher in segmental than marginal resection group. **Conclusion:** Marginal resection of mandible is effective for patient with oral squamous cell carcinoma in the early stage. Post-operative outcome and local control of disease in segmental group were slightly higher than marginal group. Positive surgical margin status and bone invasion was found as the most important predictor of local control of the diseases in patient with oral squamous cell carcinoma.

**Keywords:** Oral Squamous Cell Carcinoma (OSCC); Marginal resection; Segmental resection; Mandible

*Bangladesh Journal of Medical Science Vol. 18 No. 04 October '19. Page : 801-807  
DOI: <https://doi.org/10.3329/bjms.v18i4.42908>*

**Introduction:**

Squamous cell carcinoma is the most common (90% of all) cancer in the oral cavity. In Bangladesh, Oral cancer accounts for 20% of whole body malignancy [1] Beside these, only 10-15% of the oral cancers in Bangladesh are detected at an early stage and more than 83.4% of oral cancers at the time of diagnosis are found extensive and in late stage of malignancies. [2] The therapeutic goals in the management of

cancers in the oral cavity are eradication of the tumor, prevention of recurrence and achievement of an acceptable cosmetic appearance without compromising oncologic management. There is much debate regarding the proper operative procedure for the treatment of squamous cell carcinoma of the oral cavity.<sup>3</sup> Marginal and segmental resection of the jaw bone is often required for tumor removal in oral squamous cell carcinoma patient to maintain

**Correspondence to:** Dr. Mohammad Deedarul Alam, Assistant Professor, Department of Oral and Maxillofacial Surgery, Dental Unit, Sher-e-Bangla Medical College & Hospital, Barisal, Bangladesh  
E-mail: [dr\\_dalamdedar@yahoo.com](mailto:dr_dalamdedar@yahoo.com); website: [www.dental-facialsurgery.com](http://www.dental-facialsurgery.com)

oncological safe margin of soft and hard tissues. The choice between these types of resection depends on the extent of mandibular invasion. Segmental resection is indicated in case of cancer with gross mandibular invasion but marginal resection usually done in the absence of medullary invasion<sup>[4]</sup>. In cases where cancer does not erode the bone even though it may be in close proximity to the mandible, or where there is no indication of bone destruction, marginal resection is as effective as segmental resection.<sup>[5,6]</sup>

The bony structure of the mandible and associated soft tissues are a corner stone of function in the oral and facial region. Speech, mastication, deglutition, airway maintenance and facial appearance depend to varying degrees on the integrity of the mandible. Inadequate bony support affects all these functions. Preserving the continuity of the mandible during tumor resection reduces the morbidity considerably. If a marginal resection is possible, the lower contour of the jaw can be maintained and the reconstructive options are simplified. If a segmental resection becomes necessary, a composite resection is required; resulting in increased morbidity.<sup>[8]</sup> Tumor surgery can have significant functional and cosmetic implications, but failure to resect a mandible invaded by cancers allows disease progression. There is a general consensus that patients with mandibular invasion should be treated by surgery, including osteotomy of the area of the mandible involved. Controversy exists with regard to the extent of mandibular resection required.<sup>[9, 10, 11]</sup> However, understanding the routes of tumor entry into the mandible provides the rationale for managing these tumors with a marginal resection.<sup>[12]</sup> The presence of mandibular invasion increases with the size of the primary tumor, its proximity to the mandible and whether or not there has been previous surgery or irradiation. Clearly, there is a necessity to clarify the local control of diseases after both type of resection of the mandible to reach in therapeutic goals of oral squamous cell carcinoma (OSCC) management. Decision about the marginal or segmental resection of bone in patient with OSCC depends on our understanding of tumor invasion and pre-operative assessment of the patient.

The aim of this study was to evaluate the effectiveness of both types of resection with regard to the local control of the diseases and to assess post-operative complications after surgical treatment of oral squamous cell carcinoma involving the mandible in different stages.

#### **Materials and methods:**

This prospective study was carried out in the

Department of Oral and Maxillofacial Surgery, Dhaka Dental College and Hospital from September 2008 to August 2013. All procedures performed in this study were in accordance with the ethical standard of the institutional review Board of the National Cancer Research Committee.

Patients admitted with oral squamous cell carcinoma close to the mandible whose surgical resection involved a marginal or segmental mandibulectomy and having minimum follow-up of 12 months were included in the analysis. The study group (n=32) consisted of 9 male and 23 female who ranged in age from 25 to 56 years. Twenty cases underwent marginal resection and 12 cases segmental resection. Informed consent was obtained from all individual human participants included in the study.

**Inclusion criteria:** Patients with oral squamous cell carcinoma confirm by histopathology and clinical assessment. Patients are with radiological findings of bony invasion in the lower jaw.

**Exclusion criteria:** Patient not fit for major surgical intervention or associated systemic diseases. Non-co-operative and psychotic patient or patients refused to surgical intervention.

All patients with oral squamous cell carcinoma involving mandible recruited for this study were selected on the basis of the following variables : age, sex, primary site of tumor, pre-operative staging result, pathological cervical node stage, pathological tumor stage, radiological findings of bone invasion, histopathological pattern of invasion: e.g. lymphovascular invasion, perineural invasion and depth of bone invasion reported by the histopathologist; histopathological status of surgical margin of soft tissue, post-operative complication and result of follow-up etc.

**Clinical assessment:** Mandibular invasion was assessed pre-operatively by clinical examination and Panoramic radiograph (OPG). Computed tomography (CT) scan were used in suspected cases (n=17), when bony invasion was not clear by OPG. Segmental resection or en block resection of a variable length of mandible was considered in patient with evidence of cancerous invasion. The term 'marginal resection' was reserved for cancers close to the mandible with no invasion, minimal cortical invasion, or with early erosive invasion, when bony continuity has preserved. The resected specimen was send to a single pathologist for post-operative histopathological report. The soft tissue part was assessed separately. Histopathological status of surgical margin, histopathological pattern of

mandibular invasion, pathological cervical node and tumor stage was recorded from the post-operative histopathological report. Patients were followed up at 1<sup>st</sup> week, 4<sup>th</sup> week, 3 month, 6 month, 1 year and 2 years post operatively after discharging from the hospital by cell phone contact or direct reporting of the patient. Then functional outcome and complaint of the patients were recorded in the data sheet. Clinical, radiologic, histopathological findings and post-operative records within the follow-up period were compared to assess final outcome.

**Data collection techniques:** A standardized structured data collection sheet was used to collect necessary information of the subject group. Patient's name, address and contact number also noted in the data sheet for future follow-up and further communication. Data sheet included all of the variables related to the study.

**Data analysis:** All the data were screened and entered in to template of SPSS@16 software. Descriptive statistics were generated to see the distribution of baseline characteristics of the patient and outcome of intervention. Cross tabulation of treatment group and base line characteristics was done to assess any difference among the patients; P-value was generated through chi square test. After the intervention, treatment outcome was compared through chi square test. P value < .05 was considered as significant. Bar charts were also used to facilitate comparison between the treatment groups. For the purpose of statistical analysis the pathological tumor size was classified (according to TNM classification) as follows: PT1, PT2, PT3 and PT4.

**Ethical clearance:** The study was approved by the Ethical Review Committee and Advance Studies and Research Board of Dhaka Dental College & Hospital, Dhaka, Bangladesh.

**Results:**

Analyzing the reports of 32 cases, average age in the segmental resection group was 42.3±13.8 years, and in marginal resection group were 39.7±14 years (table-1). In 13 cases, the mandible was invaded by OSCC, of which 10 patients (83%) had segmental resection and 3 patients (15%) had marginal resection (Table -III). There was a considerable difference in the site of tumor involvement between the two groups. Buccal mucosa was highly (60%) involved in marginal group (12 of 20 cases), whereas, the retro molar trigon was the most common site (41.7%) in

the segmental group (5 of 12 cases). Other site of distribution was similar in both groups, p>0.05 (Fig 1). According to the histological findings in the surgical specimen, positive neck node (PN1) was found in 12(37%) cases and negative neck node (PN0) was found in 20 (63%) cases. These differences were statistically significant, p<0.05. On the other hand, PT1 size was found higher (60%) in marginal group (12 of 20 cases) than in segmental group (25%). However, a higher proportion of patient (75%) had pathological T2 size lesion in the segmental group (9 of 12 cases) than in the marginal group (30%) (Table: II). Histopathological pattern of invasion was identified in 29 cases, including 85% patient in the marginal group (17 of 20 cases) and 100% of patient in the segmental group, of which 'infiltrative' pattern of invasion was found higher (83.3%) in segmental than in marginal group (40%) (Table: III). These differences were statistically significant, (p<0.05). Soft tissue surgical margin was positive in 7 patients (21.9%), including 4 cases in the marginal group (20%) and 3 in the segmental group (25%). This difference was not statistically significant (p>0.05) (Table: IV). In follow-up analysis, speech difficulty, trismus and mastication problems were higher in segmental than marginal group. These differences were not statistically significant (p>0.05). However, changes of facial appearance in the segmental group were significantly higher than marginal group (Table: V). beside these, 75% of the segmental resection group and 65% of the marginal resection group were alive without recurrence of oral cancer. Nevertheless, two of 12 cases (8.3%) in the segmental group and 2 of 20 cases (15%) in the marginal group with positive neck node (PN1) has died in the final follow-up (Fig:2).

**Table-I: Distribution of the subjects by age and gender**

Age	Marginal	Segmental	Total	χ <sup>2</sup> & p-value
<= 40 years	7 (35)	3 (25)	10 (31.2)	χ <sup>2</sup> =1.23 p=.53
41 - 50 years	6 (30)	6 (50)	12(37.5)	
> 50 years	7 (35)	3 (25)	10 (31.2)	
<b>Gender</b>				
Male	6 (30)	3(25)	9(28.1)	χ <sup>2</sup> =.93 p=.76
Female	14(70)	9(75)	23(71.9)	

Table: 1 shows no statistically significant difference both in age and sex distribution (p>.05). x<sup>2</sup>=3.43p=.489

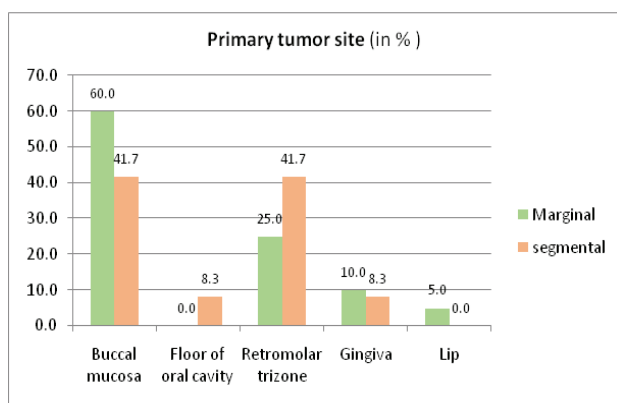


Figure 1: Primary tumor site

Note: In the marginal resection group 60% had the tumor at buccal mucosa, 25% had at retro-molar trigon. In the segmental resection group 41.7% had the tumor at buccal mucosa and 41.7% had at retro-molar trigon.

**Table -II: Baseline characteristics of the tumor**

Staging	Marginal	segmental	Total	x <sup>2</sup> & p value
Stage 1	6 (30.0)	0 (0.0)	06(18.8)	
Stage 2	14 (70.0)	3 (25.0)	17(53.1)	
Stage 3	0 (0.0)	8 (66.7)	08(25.0)	x <sup>2</sup> =21.5 p=.001
Stage 4	0 (0.0)	01(08.3)	01(03.1)	
<b>Pathological cervical node stage</b>				
PN0	16(80.0)	4(33.3)	20(63.0)	
PN1	4(20.0)	8(66.7)	12(37.0)	x <sup>2</sup> =5.1 p=.024
<b>Pathological tumor size status</b>				
PT1	12 (60.0)	3 (25.0)	15(46.9)	
PT2	6(30.0)	9(75.0)	15(46.9)	x <sup>2</sup> =4.96 p=.084
PT3	2(10.0)	0(0)	2( 6.2)	

Note: Cervical lymph node status was significantly negative in both group of patients (p<0.05). However, higher proportion of patient had pathological T2 size in segmental (75%) than in the marginal group (30%).

**Table -III: Mandibular invasion**

Mandibular invasion (Radiological)	Marginal	segmental	Total	x <sup>2</sup> & p value
Yes	3 (15.0)	10 (83.3)	13(40.6)	
No	17(85.0)	2(16.7)	19(59.4)	x <sup>2</sup> =14.5 p=.001
<b>Histopathological pattern of invasion (in resected specimen)</b>				
Erosive	9 (45.0)	2 (16.7)	11 (34.4)	
Infiltrative	8(40.0)	10(83.3)	18(56.2)	x <sup>2</sup> =6.1 p=.056
No invasion	3(15.0)	0(0)	3(9.4)	

Note: Mandibular invasion was significantly more in segmental group (p< .05), however, pattern of invasion was statistically indifferent in two treatment group (p>.05).

**Table -IV: Histopathological status of surgical margin**

Soft tissue Surgical margin	Marginal	segmental	Total	x <sup>2</sup> & p-value
Margin free	16 (80.0)	9 (75.0)	25(78.1)	
Margin not free	4(20.0)	3(25.0)	7(21.9)	x <sup>2</sup> =.11 p=.74

Note: Soft tissue margin was positive only in 25% cases of segmental group and 20% cases of marginal group. The percentage was not statistically significant (p>0.05).

**Table- V: Comparison of post- operative morbidity**

Complication	Marginal (20)	Segmental (12)	Total (32)	x <sup>2</sup> & p value
Speech difficulty	1 (05.0)	2(16.0)	3 (09.3)	χ <sup>2</sup> =.492 P=.438
Trismus	8 (40.0)	7(58.3)	15 (46.9)	χ <sup>2</sup> =1.01 P=.314
Mastication problem	9 (45.0)	8(66.7)	17 (53.1)	χ <sup>2</sup> =1.41 P=.234
Respiratory problem	2 (10.0)	1 (8.3)	3 (9.3)	χ <sup>2</sup> =1.28 p=.258
Facial appearance Change	2 (10.0)	9 (75.0)	11 (34.4)	χ <sup>2</sup> =11.5 p=.001*

Note: Regarding facial appearance change in marginal group, the percentage is only 10%, however, in segmental group the percentage is 75%. The difference is statistically significant (p< .05).

**Discussion:**

Oral squamous cell carcinoma involving the mandible often vulnerable for tumor progression, if patient delay to receive early treatment. Most of the patients with oral cancer in this sub- continent, reported to the surgeon in late stage of tumor progression, when resection of mandible cannot be avoided to save the patients. The concept of mandibular preservation is closely related to an improved understanding of the

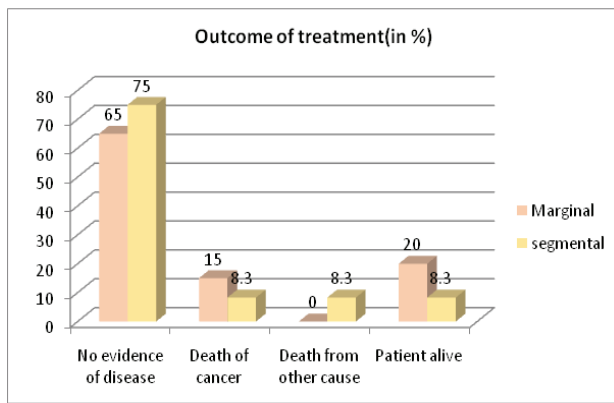


Figure 2: Outcome of treatment

Note: Death from cancer is higher in marginal than segmental resection group (15% versus 8.3%)

manner of spread of oral cavity neoplasm.<sup>[3]</sup> for that reason, marginal mandibulectomy has the potential of removing the tissues at risk over an adequate length without significantly disturbing mandibular form. Surgical margin in the present series were positive in only 20% of marginal resection and 25% of segmental resection groups (Table-IV). Segmental resection appeared to be associated with improved local control among patients with bone invasion. The presence of positive soft tissue margins was the only factor which predicted for local recurrence. In this study, the intra and post-operative evaluation yielded clear soft tissue margin in maximum cases (Table-iv).

According to the study of Robert A.ORD et al<sup>14</sup>, most tumors occurred in the floor of the mouth were treated by marginal resection, where as in the segmental resection group the retromolar trigon was the most common site. Mandible was involved in 65% of patients with segmental resection and 7.6% of patients who had a marginal resection. In the present study, mandibular invasion was found higher in segmental (83.3%) rather than marginal group (15%). Most tumors occurred in the Buccal mucosa was treated by marginal resection and oral cancer involved in retro molar trigon was mostly treated by segmental resection of the jaw (Fig: 1). This can be partly explained that retro molar area may be a common site of tumor invasion into the mandible and show more aggressive pattern rather than other site. Oral squamous cell carcinoma involve in retro molar site should be treated by segmental resection of the jaw.

Mario F, Monoz Guerra et al<sup>3</sup> observed that, Segmental resection causes severe functional and cosmetic problems due to loss of continuity of the mandible, which hampers oral rehabilitation

including mastication to a great extent. In the present study group, trismus and mastication problem was found more in segmental rather than marginal group; changes of facial appearance was found significantly higher (75%) in segmental group (Table: V).

The studies of the Bremerich<sup>[15]</sup> and co-workers have shown that tumor size and site alone cannot provide the indication for a segmental resection. They found that in 41.2% of their T4 tumors, the histological examination yielded no malignant infiltration of the mandibular bone. Consequently, they advised conservative bone resection method in cases with no clinical and radiological signs of bone destruction.

<sup>[15]</sup> In the present study, marginal resection was done 30% in stage 1 and 70% in stage 2 tumor and segmental resection was done 25% in stage 2 and 67.7% in stage 3 tumors. Segmental resection was mostly done in stage 3 tumors with clinical and radiological findings of progressive tumor invasion (Table- II and III).

Other studies of Barttelbort and Ariyan<sup>[16]</sup> have suggested that, marginal resection in selected patients resulted in satisfactory control and was believed to be as effective as segmental resection. In examining the effectiveness of these techniques, the present study observe that 65% patients with marginal group were alive and cancer free, who were treated in early tumor stage (T1,T2), compared with 75% of Patients in segmental group(T2, T3, T4) who had no evidence of diseases at the final follow-up[Fig-2].

It is the hypothesis that early tumor invasion shows an 'erosive' pattern, when tumour advances on a broad front with a connective tissue layer, which changes to an 'invasive' or 'infiltrative' pattern as the disease progresses within the mandible.<sup>[17]</sup> In this study, histopathological pattern of tumour invasion was identified in most (29 out of 32) cases, of which 'infiltrative' pattern of invasion was found higher (83.3%) in segmental than marginal group (40%). Mandibular invasion was significantly more in segmental group ( $p < .05$ ) (Table -III). Due to the statistical significant difference of infiltrative pattern of invasion in segmental compared with marginal group, we suggest that, infiltrative or invasive OSCC should be treated by segmental resection technique. This is in keeping with findings of Brown et al<sup>18</sup>, Brown and Brown<sup>17</sup> but contrary to those of Bremerich et al<sup>15</sup>.

In another study Dubner and Heller<sup>11</sup> and Robert. A<sup>14</sup>, have shown that, overall survival dependent on tumour stage, nodal stage and bone invasion. In the present study, a higher proportion of patients (75%)

had PT2 and PT3 tumour stage in the segmental group (9 of 12 cases) than in the marginal group, positive neck node (PN1) was found higher (66.7%) in segmental than marginal group (20%). Negative neck (PNo) was found in 63% (20 of 32 cases) of the study group (Table- II). Comparison of the treatment outcome suggested that, death from cancer is almost half in segmental than marginal resection group (8.3% versus 15%) (Fig:2). The results of our study were similar with the findings of Dubner and Heller (1993)<sup>[11]</sup> in that there is lower survival rates in marginal than segmental group. Totsuka et al (1991)<sup>[19]</sup> and Barttelbort et al (1987)<sup>[10]</sup> observe no difference in outcome in their series of patients undergoing segmental or marginal resection, which shows equivalent local control rates in both group of resection technique.

**Limitation of the study:** It is difficult to reach in firm conclusion from this study of small sample size and unequal distribution of the sample group.

**Conclusion:**

Mandibular conservation surgery is an effective method for patient with oral squamous cell carcinoma in the early stage. Post-operative outcome and local control of disease in segmental group were slightly higher than marginal group. Positive soft tissue

margin and bone invasion was found as an important predictor that influences the local control of the disease.

**Acknowledgement:**

I like to thank my respective teachers and staff of the Department of Oral and Maxillofacial Surgery, Dhaka Dental College & Hospital, for their assistance in performing this study.

**Funding:**

The study was not funded by any organization. It was done by self-finance of the author for mandatory dissertation work as a pre-requisite to attend the fellowship examination in Bangladesh College of Physicians and Surgeons (BCPS) within 2008-2013.

**Conflict of interest:**

We like to declare that we've no conflict of interest.

**Authors' contribution:**

Data gathering and idea owner of this study:

Mohammad Deedarul Alam

Study design: Mohammad Deedarul Alam

Data gathering: Mohammad Deedarul Alam

Writing and submitting manuscript: Mohammad Deedarul Alam

Editing and approval of final draft: Mohammad Deedarul Alam

**References:**

1. Shaheed I, Molla M.R, Amzad Hossain (1995): Histological and causative factor of oral cancer in Bangladesh. *Oral Oncology*, Vol 4A, Applied proceedings of the 4<sup>th</sup> Intl Congress on oral cancer, Sept 1995, page 27-30.
2. Morshed AT, Molla MR et al 1997: Aretrospective study of oral cancer and its cervical lymph node metastasis in Bangladesh. *Bangladesh Dental Journal*, vol-13:1, page-21-26, 1997
3. Mario Fernando, Monoz Guerra, Luis Naval Gias et al 2003: Marginal and Segmental mandibulectomy in patients with oral cancer-A statistical analysis of 106 cases. *J Oral Maxillofac Surg*(2003) Vol-61:11,P-1289-1296.
4. Ellen M. Van Cann et al 2005: Health related quality of life after mandibular resection for oral and oropharyngeal SCC; *Oral Oncology* Vol 41:7, page-687-693.
5. Diana Wolf, Stefen Hassfeld and Christof Hofele 2004: Influence of marginal and segmental mandibular resection on the survival rate in patients with SCC of the inferior part of the oral cavity. *J Cranio Maxillofac Surg*, Vol 32:5, page 318- 323
6. Guerra et al 2003: Rim versus Sagittal mandibulectomy for the treatment of SCC: two types of mandibular preservation: *Head Neck* vol 25(20003) page:982-989.
8. Kroll et al 1996: Choice of flap and incidence of free flap success, *Plastic reconstructive surgery*, 98, page: 459-463.
9. O'Brien et al 1986: Invasion of mandible of by scc of the oral cavity & oropharynx. *Head Neck surg*, vol 8 (1986) page: 247-256.
10. Barttelbort et al 1987: Rim mandibulectomy for cancer of the oral cavity. *Am J Surg*, VOL 154 page:423-428
11. Dubner and Heller 1993: Local control of SCC following marginal and segmental mandibulectomy. *Head Neck* vol 15(1993) page 24-32.
12. Eric .M. Genden et al 2005: Management of mandibular invasion, When is marginal mandibulectomy appropriate?: *Oral Oncology* vol:41:8 page:776-782.
13. C J O'Brien, J R Adams et al 2003: Influence of bone invasion and extent of mandibular resection on local control of cancers of the oral cavity and oropharynx. *Int J OMS*, 32:492-497
14. Robert. A. Ord, Majgan Sarmadi and John Papadimitrou(1997): A Comparison of segmental and marginal bony resection for oral SCC involving the mandible. *J OMS*, VOL 55: page-470-477.
15. Bremerich et al 1992-Indication for partial mandibular resection in tumors of floor of the mouth. page-98-100, *Scopus*.
16. Bartellbort S.W, Ariyan S 1993: Mandible preservation with oral cavity carcinoma: rim versus sagittal mandibulectomy. *Am J Surg* 1993, 166:411-415.
17. Brown J.S and R.M. Brown 1995: Factors influencing the pattern of invasion of the mandible by Oral SCC. *Intl J OMS* 24(1995) page: 417-424.
18. Brown J.S, D.Lowe et al 2002: Pattern of invasion of routes of tumor entry into the mandible by Oral SCC, *Head Neck* 24, page: 370-383
19. Totsuka .Y, Y. Usui et al 1991: Mandibular involvement by SCC of the lower alveolus: Analysis and comparative study of histological and radiological features, *Head Neck* 13 (1991) page 40-50.