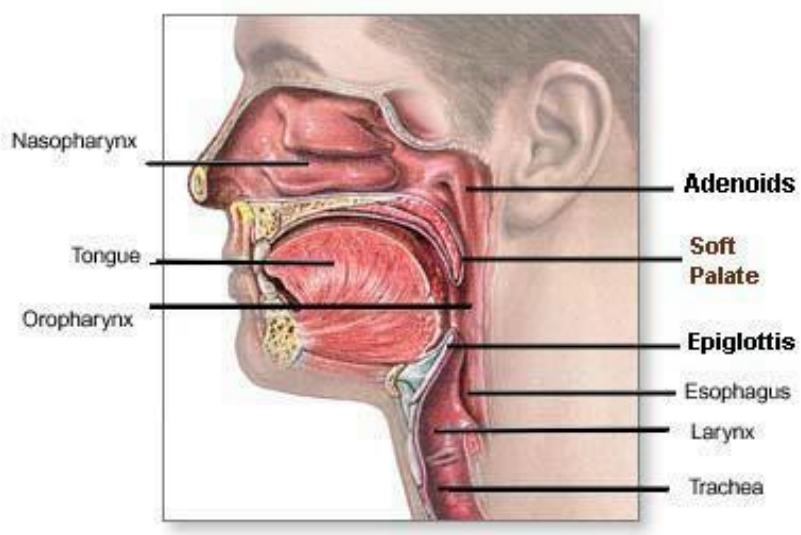
Cancer Association of South Africa
(CANSA)

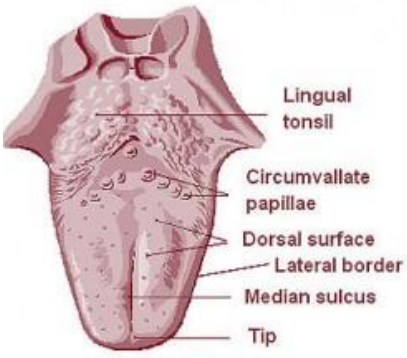
Fact Sheet
on
Cancer of the Tongue

Introduction

The tongue is a muscular organ on the floor of the mouth of most vertebrates which manipulates food for mastication (chewing). It is the primary organ of taste (gustation), as much of the upper surface of the tongue is covered in papillae and taste buds. The tongue is very sensitive and is kept moist by saliva. It is richly supplied with nerves and blood vessels. In humans an additional function of the tongue is phonetic articulation (speech). The tongue also serves as a natural means of cleaning one's teeth.



[Picture Credit: Tongue]



While the tongue's muscles guide food between the teeth and shape it so that it is digestible, the peripheral sense organ is perhaps better known for its role in the perception of taste. The tongue not only detects gustatory (taste) sensations, but also helps sense the tactile, thermal and even painful stimuli that give food its flavour.

[Picture Credit: Tongue 2]

Many people mistake the bumpy structures that cover the tongue's surface for taste buds. These are actually papillae: goblet-shaped elevations that sometimes contain taste buds and help create friction between the tongue and food. Taste buds are smaller structures, tucked away in the folds between papillae. Every taste bud is made up of basal and supporting cells that help maintain about 50 gustatory receptor cells. These specialised receptors are stimulated by the chemical makeup

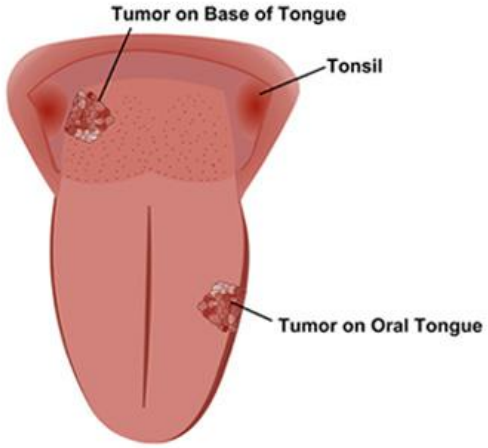
Researched and Authored by Prof Michael C Herbst
[D Litt et Phil (Health Studies); D N Ed; M Art et Scien; B A Cur; Dip Occupational Health; Dip Genetic Counselling; Dip Audiometry and Noise Measurement; Diagnostic Radiographer; Medical Ethicist]
Approved by Ms Elize Joubert, Chief Executive Officer [BA Social Work (cum laude); MA Social Work]

of solutions. They respond to several primary tastes: sweet, salty, bitter, sour, umami (savory) and fat, which some scientists claim might be a sixth taste. When a stimulus activates a gustatory cell, the receptor will synapse with neurons and send an electrical impulse to the gustatory region of the cerebral cortex. The brain interprets the sensation as taste.

Cancer of the Tongue

Cancer of the tongue is cancer that develops in or on the tongue. Cancer occurs when cell growth becomes erratic and abnormal; specifically, it tends to grow much too quickly. Many factors can cause or increase the risk of developing cancer.

Tongue cancer is classed as a mouth or oropharyngeal cancer. There are two parts to the tongue, the oral tongue and the base of the tongue. Cancer can develop in either part of the tongue. The oral tongue is the part one can see when the tongue is poked out. This is the front two thirds of your tongue. Cancers that develop in this part of the tongue come under a group of cancers called mouth (oral) cancers.



[Picture Credit: Areas of Tongue]

The base of the tongue is the back third of the tongue. This part is very near the throat (pharynx). Cancers that develop in this part of the tongue are called oropharyngeal cancers.

Tumours on the base of the tongue are usually larger when diagnosed because in the early stages the tumour is difficult to see. The only early symptom is ear pain. Voice changes and difficult swallowing occur later.

Because bases of the tongue cancer is diagnosed later, the cancer may have already spread to the neck. A neck dissection is frequently needed to remove the affected lymph nodes.

Incidence of Cancer of the Tongue in South Africa

According to the National Cancer Registry (2014) the following number of cases of cancer of the tongue was histologically diagnosed in South Africa during 2014:

Group - Males 2014	Actual No of Cases	Estimated Lifetime Risk	Percentage of All Cancers
All males	310	1:474	0,84%
Asian males	15	1:398	1,65%
Black males	148	1:656	1,34%
Coloured males	42	1:338	1,00%
White males	104	1:280	0,51%

Group - Females 2014	Actual No of Cases	Estimated Lifetime Risk	Percentage of All Cancers
All females	112	1:1 948	0,30%
Asian females	15	1:412	1,28%
Black females	33	1:4 796	0,21%
Coloured females	15	1:1 893	0,37%
White females	48	1:754	0,29%

The frequency of histologically diagnosed cases of cancer of the tongue in South Africa for 2014 was as follows (National Cancer Registry, 2014):

Group - Males 2014	0 – 19 Years	20 – 29 Years	30 – 39 Years	40 – 49 Years	50 – 59 Years	60 – 69 Years	70 – 79 Years	80+ Years
All males	1	3	8	36	92	109	36	10
Asian males	0	2	1	2	2	3	4	0
Black males	1	1	4	16	42	53	10	4
Coloured males	0	0	0	5	18	13	4	1
White males	0	0	2	13	28	36	18	5

Group - Females 2014	0 – 19 Years	20 – 29 Years	30 – 39 Years	40 – 49 Years	50 – 59 Years	60 – 69 Years	70 – 79 Years	80+ Years
All females	0	3	5	17	37	29	11	8
Asian females	0	0	1	0	3	6	4	0
Black females	0	2	2	6	16	4	2	0
Coloured females	0	1	0	4	6	0	1	3
White females	0	0	2	6	12	19	4	5

N.B. In the event that the totals in any of the above tables do not tally, this may be the result of uncertainties as to the age, race or sex of the individual. The totals for 'all males' and 'all females', however, always reflect the correct totals.

Risk Factors for Cancer of the Tongue

The exact causes of most head and neck cancers are not known, however several risk factors have been identified. Smoking tobacco (cigarettes, cigars and pipes) and drinking a lot of alcohol are the main risk factors for cancers of the head and neck in the western world.

Main causes for cancer of the tongue include:

- tobacco use
- alcohol use
- human papillomavirus (HPV) infection
- male gender
- certain genetic forms of anaemia - Fanconi Anaemia has been diagnosed at ages ranging from birth to >50 years of age; males and females are equally affected and it has been linked to cancer of the tongue
- a condition called Graft Versus Host Disease, which occurs in *some* patients who undergo stem cell transplants
- Oral Leukoplakia

Shearston, K., Fateh, B., Tai, S. Hove, D. & Farah, C.S. 2019.
OBJECTIVES: Oral leukoplakia (OLK) is one of the most common oral potentially malignant lesions (OPMD) and is reported to undergo malignant transformation (MT) to oral squamous cell carcinoma (OSCC) at rates of between 0.13-34%. This study seeks to determine the proportion of OLK lesions that develop into OSCC in an Australian population and assess the risk factors associated with this transformation.
METHODS: The study is a retrospective audit of patients from a private oral medicine clinic, diagnosed with OLK using clinical and histopathological data between 2006 and 2014. Patients were cross-matched with Cancer Registry data for OSCC, and the rate and time to malignant transformation determined.
RESULTS: OLK patients with histopathological confirmation of their lesions underwent MT at a rate of 1.49% (3/202), with an average time to MT (TMT) of 5.2 years. When patients without histopathological confirmation were assessed, the MT rate was slightly less (1.30%; 4.9 years TMT). Patients who transformed were more likely to be older females with a history of smoking and alcohol use, and OLK present on the tongue or floor of mouth. The rate of oral epithelial dysplasia (OED) in the transformed group was surprisingly low (1/3).
CONCLUSIONS: OLK is at a moderate risk of malignant transformation which can be reduced by careful management. Current tools for identifying high risk OLK, including histopathological assessment of OED, may not capture all lesions that undergo MT and need to be supplemented by unbiased molecular biomarkers.

Signs and Symptoms of Cancer of the Tongue
While an annual screening for oral cancer is important, it is possible that one will notice some change in one's mouth or throat that needs examination between ordinary annual screenings. A doctor or dentist should be contacted immediately when noticing any of the following symptoms:

- a sore or lesion in the mouth that does not heal within two weeks
- a lump or thickening in the cheek
- a white or red patch on the gums, tongue, tonsil, or lining of the mouth
- a sore throat or a feeling that something is caught in the throat
- difficulty chewing or swallowing
- difficulty moving the jaw or tongue
- numbness of the tongue or other area of the mouth
- swelling of the jaw that causes dentures to fit poorly or become uncomfortable
- chronic hoarseness
- pain in the ear (rare)

These symptoms may be caused by other, less serious problems, but it may also indicate the possible presence of oral cancer. Many people would think that a medical doctor is the appropriate person to visit, but dentists are trained in this simple, quick screening, which involves the examination of the oral cavity as a whole and not just teeth.

Diagnosis of Cancer of the Tongue
Besides a visual examination of all the tissues in the mouth, the doctor or dentist will feel the floor of the mouth and portions of the back of the throat with his/her fingers, in the search for abnormalities.

A thorough oral screening also includes indirect examination of the nasopharynx and larynx, and involves manually feeling the neck for swollen lymph nodes and other abnormalities such as hardened masses.

The mouth will also be checked for white patches, red patches, ulcerations, lumps, loose teeth, as well as review of dental x-rays for abnormalities. Tobacco use in any form should be reported as tobacco use is implicated in many cases of oral cancer.

If any suspicious area is identified, a biopsy may be recommended. This is simply taking a small portion of the suspicious tissue for examination under a microscope.

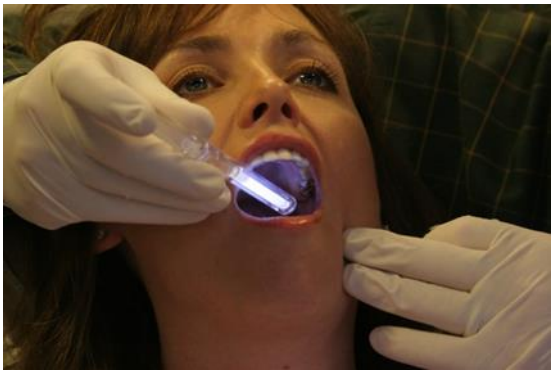
Incisional biopsy -The most traditional type of biopsy is incisional. It may be done by the doctor who did the examination, or the patient may be referred to another doctor for the procedure. In an incisional biopsy, the doctor will remove part or all of the lesion depending on its size and the ability to define the extent of the lesion at this early stage. The sample of tissue is then sent to a pathologist who examines the tissue under a microscope to check for abnormal, or malignant cells.

Fine-needle-aspiration biopsy (FNA) - When dealing with an area of significant mass, such as an enlarged lymph node, fine needle aspiration cytology (fine needle biopsy or FNB) has found an increasing role in diagnosis. The technique is reliable and relatively inexpensive. In it, a small needle attached to a syringe is inserted into the questionable mass and cells are aspirated, or pulled out into the syringe as the doctor draws back the piston of the syringe. The success of this method depends on how accurately the needle is placed, as well as the skill and experience of the tissue pathologist who will be examining the cells. It is likely that the doctor will insert the needle and draw out cellular material from several different locations in the mass to ensure that a thorough and representative sample has been taken.

Brush biopsy or exfoliative cytology **-** some dental offices are doing a 'brush biopsy' where a sampling of cells is collected by aggressively rubbing a brush against the suspect area. While this has some usefulness in preliminary evaluation of a suspect area, it is not a stand-alone procedure. If a positive find returns, this must be confirmed by a conventional incisional biopsy.

Mucosal staining - a blue dye called toluidine blue is applied to the area where cancer is suspected. If any blue areas remain after rinsing, it probably will be investigated with a biopsy.

Chemiluminescent light - after the rinsing of the mouth with a mild acid solution, the mouth will be examined with a special light. Healthy cells do not reflect the light; cancerous cells do.



[Picture Credit: Chemiluminescence]

Imaging tests, which may include:

- Computed axial tomography (CAT) scans
- Positron emission tomography (PET) scans
- Magnetic resonance imaging (MRI) scans
- Chest and dental X-rays

- Barium swallow: Also called an upper gastrointestinal (GI) series, this set of X-rays of the oesophagus and stomach may be used to look for other cancers and determine how well you swallow.
- Endoscopy – where the doctor uses a laryngoscope to look into the back of the throat to examine the base of the tongue

Types of Cancers of the Tongue

The most common type of tongue cancer is squamous cell carcinoma (SCCA). Squamous cells are the flat, skin like cells that cover the lining of the mouth, nose, larynx, thyroid and throat. SCCA is the name given to a cancer that starts in these cells.

Cancer of the tongue occurs in two different anatomical sites, namely:

Oral Tongue Cancer

- a lump on the side of the tongue that touches the teeth (lateral side)
- the lump often looks like an ulcer and is grayish-pink to red in colour
- the lump bleeds easily if bitten or touched

Base of the Tongue Cancer

- the tumour is often difficult to see in the early stages so it is usually diagnosed when it is larger
- there are few symptoms in the early stages
- in later stages, the cancer may cause pain, a sense of fullness in the throat, difficulty swallowing, the feeling of a lump in the neck or throat, voice changes or ear pain

Lowering the Risk for Cancer of the Tongue

Scientists look at risk factors and protective factors. Anything that increases one's chance of developing cancer is called a cancer risk factor, whilst anything that decreases one's chance of developing cancer is called a cancer protective factor.

Some risk factors for cancer can be avoided. For example, both smoking and inheriting certain genes are risk factors for some types of cancer, but only smoking can be avoided. Regular exercise and a healthy diet may be protective factors for many types of cancer.

Avoiding risk factors and increasing protective factors may lower your risk for cancer but it does not mean that cancer will never recur.

Reducing the cancer risk includes:

- a balanced lifestyle and healthy eating habits
- avoiding carcinogens (substances known to cause cancer)
- treating of precancerous conditions like chronic inflammation

Prognosis (Outlook)
Rates for individual mouth cancers include:

- lip cancer – 89% of patients will live for 5 years or more
- tongue cancer – 55% of women and 44% of men will live for 5 years or more
- oral cavity – this includes all other mouth cancers (not lip or tongue) - nearly 55% of women and 48% of men will be alive 5 years later

Treatment of Cancer of the Tongue
As with many types of cancer, diagnosing your cancer early means it will be easier to control and possibly cure it. The treatment for tongue cancer depends on the size of the cancer and whether or not it has spread to the lymph nodes in the neck.

Mroueh, R., Haapaniemi, A., Saarto, T., Grönholm, L., Grénman, R., Salo, T.& Mäkitie, A.A. 2019.
PURPOSE: Late-stage OTSCC is associated with poor overall survival (OS). Non-curative treatment approach aims to improve quality of life and prolong survival of patients deemed incurable. The purpose of this study was to investigate the used non-curative treatment modalities for OTSSC and patient survival.
METHODS: All patients diagnosed with OTSCC and treated with non-curative intent at the HUS Helsinki University Hospital (Helsinki, Finland) during the 12-year period of 2005-2016 were included. Survival analysis after the non-curative treatment decision was conducted using the Kaplan-Meier method in this population-based study.
RESULTS: Eighty-two patients were identified. A non-curative treatment decision was made at presentation without any previous treatment in 26 patients (7% of all patients diagnosed with OTSCC during the study period). Palliative radiotherapy was administered to 24% of all patients. The average survival time after the non-curative treatment decision was 3.7 months (median 2 and range 0-26).
CONCLUSIONS: Due to the short mean survival time after decision for treatment with non-curative intent, and the notable symptom burden in this patient population, a prompt initiation of all non-curative measures is warranted.

- Surgery - If the cancer has grown quite big, the patient may need to have an operation to remove part or all of the tongue (a glossectomy). This is a major operation and the doctor may suggest that the patient first try radiotherapy and chemotherapy to shrink the cancer. If this works, the patient may not need the surgery.

  If a person has a partial or complete removal of the tongue, it will permanently change that person's ability to speak and swallow – this will severely affect eating and drinking. This can be very hard to cope with and the person is likely to need a lot of support and help following the operation. It is important to talk to a doctor or specialist nurse before the operation.

Saidak, Z., Pascual, C., Bouaoud, J., Galmiche, L., Clatot, F., Dakpé, S., Page, C. & Galmiche, A. 2019.
OBJECTIVES: Achieving complete tumour resection is one of the main goals of surgery for head and neck squamous cell carcinoma (HNSCC) tumours. Whether biological characteristics of tumours contribute to the surgical resectability and the presence of positive surgical margins (SM) after resection of HNSCC is unclear. We aimed to address this issue.

MATERIALS AND METHODS: We used data from The Cancer Genome Atlas (TCGA) to relate the SM status of 356 HNSCC tumours covering five major primary locations (tongue, larynx, tonsils, floor of mouth and buccal mucosa) with data from multiple omics approaches (transcriptomic, genomic and proteomic analyses).
RESULTS: We identified three differentially expressed genes whose expression was significantly associated with the presence of positive SM in tongue tumours (n = 144). The three genes (CCDC66, ZRANB2 and VCPKMT) displayed significantly higher mRNA levels in tonguetumours with positive SM compared to tumours with negative SM. The corresponding gene expression signature identified tongue tumours with a positive SM with high sensitivity and specificity (85% and 76%, respectively, Area Under the Curve (AUC) = 0.84). Tongue tumours with this signature were characterised by a high grade, elevated proliferation levels and a tumour stroma with fewer fibroblasts and endothelial cells.
CONCLUSION: Positive SM were found to be strikingly associated with tumour biology in tongue tumours. These findings offer interesting perspectives for biomarker identification and precision surgery in these tumours.

Marra, A., Violati, M., Broggio, F., Codecà, C., Blasi, M., Luciani, A., Zonato, S., Rabbiosi, D., Moneghini, L., Saibene, A., Maccari, A., Felisati, G. & Ferrari, D. 2019.
PLAIN-LANGUAGE-SUMMARY: "Early and loco-regionally advanced oral tongue squamous cell carcinoma (OTSCC) can be treated by surgery alone or followed by adjuvant radiotherapy or chemoradiotherapy. Nevertheless, up to 40% of patients develop tumour relapse. The aim of our study is to investigate the clinical and pathological features associated with reduced disease-free survival (DFS) in a cohort of surgically-resected OTSCC patients. One hundred and six patients surgically resected for OTSCC were retrospectively identified from clinical records. DFS was calculated according to the Kaplan–Meier method and differences between variables were assessed with Log-Rank test. A multivariable Cox regression model was used to analyse the impact of different prognostic factors on DFS. After a median of follow-up of 8.9 years, 22 events, including 11 deaths, were observed. Overall, the 5-year DFS-rate was 87.4%. The presence of extra-nodal extension (p = 0.023) and perineural invasion (p = 0.003) were significantly correlated with shorter DFS (in univariate analysis). In multivariable analysis, extra-nodal extension and perineural invasion confirmed their role as independent prognostic factors associated with an increased risk of disease recurrence [hazard ratio (HR) 2.87, 95% CI 1.11-7.42, p = 0.03; HR 3.85, 95% CI 1.49-9.96, p = 0.006, respectively]. p16 and p53 expressions in tumour cells were detected in 12% (n = 9) and 46% (n = 40) of cases, respectively. No differences in DFS were observed between p16+ and p16- (p = 0.125) and between p53+ and p53- tumours (p = 0.213). In conclusion, radical surgery, eventually followed by adjuvant radiotherapy or chemo-radiotherapy, can achieve high cure rates in OTSCC. After long-term follow-up, perineural invasion and extra-nodal extension confirmed their role as prognostic factors associated with reduced DFS in OTSCC patients."

- <u>Radiotherapy</u> - Intensity-Modulated Radiation Therapy (IMRT)
  Radiation therapy may be prescribed before surgery, after surgery, or sometimes as the only treatment. Radiation uses high-energy X-rays, electron beams, or radioactive isotopes to destroy cancer cells.

  IMRT uses a computer to help calculate the precise dose of radiation needed for the tumour. This minimizes radiation exposure to the surrounding normal tissue. IMRT uses a more effective radiation dose with fewer side effects than conventional radiotherapy techniques.

Radiation therapy, including IMRT, stops cancer cells from dividing. The dose of radiation is calculated to damage only the rapidly dividing cancer cells. It causes only minimal damage to the normal tissues in the path of the radiation beam. Radiation therapy usually involves 5-6 weeks of daily treatments.

- Intensity-Modulated Radiation Therapy (IMRT)
  Radiation therapy may be prescribed before surgery, after surgery, or sometimes as the only treatment. Radiation uses high-energy X-rays, electron beams, or radioactive isotopes to destroy cancer cells.

  IMRT uses a computer to help calculate the precise dose of radiation needed for the tumour. This minimizes radiation exposure to the surrounding normal tissue. IMRT uses a more effective radiation dose with fewer side effects than conventional radiotherapy techniques.

  Radiation therapy, including IMRT, stops cancer cells from dividing. The dose of radiation is calculated to damage only the rapidly dividing cancer cells. It causes only minimal damage to the normal tissues in the path of the radiation beam.

  Radiation therapy involves 5-6 weeks of daily treatments.

- Chemotherapy - Although chemotherapy alone will not cure this type of cancer, it helps control growth of the tumour when used in combination with surgery or radiation therapy.

  Chemotherapy is prescribed in different ways:
  - together with radiation as an alternative to surgery (called chemoradiation)
  - after surgery to decrease the risk of the cancer returning
  - to slow the growth of a tumour and control symptoms if the cancer cannot be cured (palliative treatment)

Almahmoudi, R., Salem, A., Murshid, S., Dourado, M.R., Apu, E.H., Salo, T. & Al-Samadi, A. 2019.
"We recently showed that extracellular interleukin-17F (IL-17F) correlates with better disease-specific survival in oral tongue squamous cell carcinoma (OTSCC) patients. However, the underlying mechanisms of such effect remain obscure. Here, we used qRT-PCR to assess the expression of IL-17F and its receptors (IL-17RA and IL-17RC) in two OTSCC cell lines (HSC-3 and SCC-25) and in normal human oral keratinocytes (HOKs). IL-17F effects on cancer cell proliferation, migration, and invasion were studied using a live-imaging IncuCyte system, and a Caspase-3/7 reagent was used for testing apoptosis. 3D tumor spheroids were utilized to assess the impact of IL-17F on invasion with or without cancer-associated fibroblasts (CAFs). Tube-formation assays were used to examine the effects of IL-17F on angiogenesis using human umbilical vein endothelial cells (HUVEC). OTSCC cells express low levels of IL-17F, IL-17RA, and IL-17RC mRNA compared with HOKs. IL-17F inhibited cell proliferation and random migration of highly invasive HSC-3 cells. CAFs promoted OTSCC invasion in tumor spheroids, whereas IL-17F eliminated such effect. IL-17F suppressed HUVEC tube formation in a dose-dependent manner. Collectively, we suggest that IL-17F counteracts the pro-tumorigenic activity in OTSCC. Due to its downregulation in tumor cells and inhibitory activity in in

vitro cancer models, targeting IL-17F or its regulatory pathways could lead to promising immunotherapeutic strategies against OTSCC."

A patient may have one of the above treatments or a combination of treatments. The best treatment for very small tongue cancers is surgery. For larger tumours that have spread to the lymph nodes in the neck, the person will most likely have a combination of surgery and radiotherapy. This means having an operation to remove the cancer from the tongue and the lymph nodes in the neck. The person may need to have all the nodes on one or both sides of the neck removed. The operation is called a neck dissection. It lowers the risk of the cancer coming back in the future. Surgery will then be followed by a course of radiotherapy to help get rid of any cancer cells left behind.

Lifestyle Changes Following a Diagnosis of Cancer of the Tongue
After treatment, the treating doctor will usually recommend:

- therapy to improve tongue movement, chewing, and swallowing
- speech therapy, if use of the tongue is affected
- close monitoring of the patient's mouth, throat, oesophagus and lungs to see if the cancer has come back or spread

About Clinical Trials
Clinical trials are research studies that involve people. They are conducted under controlled conditions. Only about 10% of all drugs started in human clinical trials become an approved drug.

Clinical trials include:

- Trials to test effectiveness of new treatments
- Trials to test new ways of using current treatments
- Tests new interventions that may lower the risk of developing certain types of cancers
- Tests to find new ways of screening for cancer

The South African National Clinical Trials Register provides the public with updated information on clinical trials on human participants being conducted in South Africa. The Register provides information on the purpose of the clinical trial; who can participate, where the trial is located, and contact details.

For additional information, please visit: www.sanctr.gov.za/

Medical Disclaimer
This Fact Sheet is intended to provide general information only and, as such, should not be considered as a substitute for advice, medically or otherwise, covering any specific situation. Users should seek appropriate advice before taking or refraining from taking any action in reliance on any information contained in this Fact Sheet. So far as permissible by law, the Cancer Association of South Africa

(CANSA) does not accept any liability to any person (or his/her dependants/estate/heirs) relating to the use of any information contained in this Fact Sheet.

Whilst the Cancer Association of South Africa (CANSA) has taken every precaution in compiling this Fact Sheet, neither it, nor any contributor(s) to this Fact Sheet can be held responsible for any action (or the lack thereof) taken by any person or organisation wherever they shall be based, as a result, direct or otherwise, of information contained in, or accessed through, this Fact Sheet.

Sources and References Consulted or Utilised

About.Com
http://ent.about.com/od/entdisorderssu/f/What-Is-Tongue-Cancer.htm

Almahmoudi, R., Salem, A., Murshid, S., Dourado, M.R., Apu, E.H., Salo, T. & Al-Samadi, A. 2019. Interleukin-17F has anti-tumor effects in oral tongue cancer. *Cancers (Basel).* 2019 May 11;11(5). pii: E650. doi: 10.3390/cancers11050650.

Areas of Tongue
https://www.cedars-sinai.edu/Patients/Programs-and-Services/Head-and-Neck-Cancer-Center/Treatment/Tongue-Cancer-Treatment.aspx

Buzzle
http://www.buzzle.com/articles/tongue-cancer-stages.html

Cancer Research UK
http://www.cancerresearchuk.org/cancer-help/about-cancer/cancer-questions/tongue-cancer
http://www.cancerresearchuk.org/cancer-help/type/mouth-cancer/treatment/statistics-and-outlook-for-mouth-cancers

Cedars-Sinai
http://www.cedars-sinai.edu/Patients/Health-Conditions/Tongue-Cancer.aspx
http://www.cedars-sinai.edu/Patients/Programs-and-Services/Head-and-Neck-Cancer-Center/Treatment/Tongue-Cancer-Treatment.aspx

Chemiluminescence
https://www.google.co.za/search?q=chemiluminescent+light&source=lnms&tbm=isch&sa=X&ei=LpX7UajlLcOZhQfh_YCICg&sqi=2&ved=0CAcQ_AUoAQ&biw=1366&bih=614#facrc=_&imgdii=_&imgrc=tDeI2gOrXaVj4M%3A%3BEmNr4YZekGhutM%3Bhttp%253A%252F%252Fc1-preview.prosites.com%252F67026%252Fwy%252Fimages%252F0106zila%252520062.jpg%3Bhttp%253A%252F%252Fwww.twincitiesdentalstudio.com%252Fvizilite%2525C2%2525AE-plus%252F%3B3504%3B2336

HowStuffWorks
http://science.howstuffworks.com/life/human-biology/tongue2.htm

Marra, A., Violati, M., Broggio, F., Codecà, C., Blasi, M., Luciani, A., Zonato, S., Rabbiosi, D., Moneghini, L., Saibene, A., Maccari, A., Felisati, G. & Ferrari, D. 2019. Long-term disease-free survival in surgically-resected oral tongue cancer: a 10-year retrospective study. *Acta Otorhinolaryngol Ital*. 2019 Apr;39(2):84-91. doi: 10.14639/0392-100X-2336.

MD Anderson Cancer Center
http://www.mdanderson.org/patient-and-cancer-information/cancer-information/cancer-types/oral-cancer/diagnosis/index.html

Mroueh, R., Haapaniemi, A., Saarto, T., Grönholm, L., Grénman, R., Salo, T.& Mäkitie, A.A. Non-curative treatment of patients with oral tongue squamous-cell carcinoma. Eur Arch Otorhinolaryngol. Eur Arch Otorhinolaryngol. 2019 May 8. doi: 10.1007/s00405-019-05456-y. [Epub ahead of print].

National Cancer Institute
http://marrowfailure.cancer.gov/FA.html
http://www.cancer.gov/clinicaltrials/learningabout/what-are-clinical-trials

NYU Langone Medical Center
http://www.med.nyu.edu/content?ChunkIID=11498

Oral Cancer Foundation
http://www.oralcancerfoundation.org/diagnosis/

Saidak, Z., Pascual, C., Bouaoud, J., Galmiche, L., Clatot, F., Dakpé, S., Page, C. & Galmiche, A. 2019. A three-gene expression signature associated with positive surgical margins in tonguesquamous cell carcinomas: Predicting surgical resectability from tumour biology? *Oral Oncol*. 2019 Jul;94:115-120. doi: 10.1016/j.oraloncology.2019.05.020. Epub 2019 May 30.

Shearston, K., Fateh, B., Tai, S. Hove, D. & Farah, C.S. 2019. Malignant transformation rate of oral leukoplakid in an Australian population. *J Oral Pathol Med*. 2019 Jun 7. doi: 10.1111/jop.12899. [Epub ahead of print]

Tongue
http://www.bing.com/images/search?q=ree+pics+anatomy+tongue&view=detail&id=8CA5511CD7F9820A94B619AF90013CAD3EAC18B1&first=391&FORM=IDFRIR

Tongue 2
http://www.bing.com/images/search?q=ree+pics+anatomy+tongue&view=detail&id=1C7C7DF86027A15ABF833384B63E02F7F0B5CC13&qpvt=ree+pics+anatomy+tongue&FORM=IDFRIR