for fifteen minutes. The right side of the head and face was badly cut and three ribs were broken, but his chief complaint was pain in the back of the neck. He was unable to turn his head in any direction on account of the pain in the neck. He was taken to a hospital, where he was told that his neck was sprained. He was twelve days in bed, being treated for the fractured ribs and other injuries, though his chief complaint was pain in the neck. No roentgenogram was taken at this time. Three weeks later, twenty-two days after the injury, the pain persisting, a roentgenogram was taken, which showed a dislocation backward of the fifth cervical vertebra with fracture of the body of the fourth cervical. Neurologic examination at this time was entirely negative. There was no impairment of motility or sensation and no alteration of the deep or superficial reflexes. The patient carried his head in a peculiar stiff manner, though he could move it without much discomfort. A plaster collar was applied and he is still under observation.

315 West Ninety-Seventh Street.

CANCER OF THE ORAL CAVITY, JAWS AND THROAT

TREATMENT BY ELECTROTHERMIC METHODS OR IN COMBINATION WITH SURGERY, THE ROENTGEN RAY AND RADIUM, WITH AN ANALYSIS OF TWO HUNDRED CASES SO TREATED *

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Electrothermic methods are peculiarly adapted to the treatment of cancer within the mouth. Malignant tissue (including bone) occurring in any part of the oral cavity, comprising the lips, buccal surface, tongue, floor of the mouth, alveolus, hard palate, antrum, tonsils, pharynx, epiglottis, larynx and proximal end of the esophagus, may be destroyed with one electrothermic operation.

It is not necessary to split the cheek surgically to render a growth accessible to treatment, since the exposure secured by the use of a mouth gag, cheek retractors, traction on tongue by means of a suture or tongue forceps, or by the use of an endoscope is

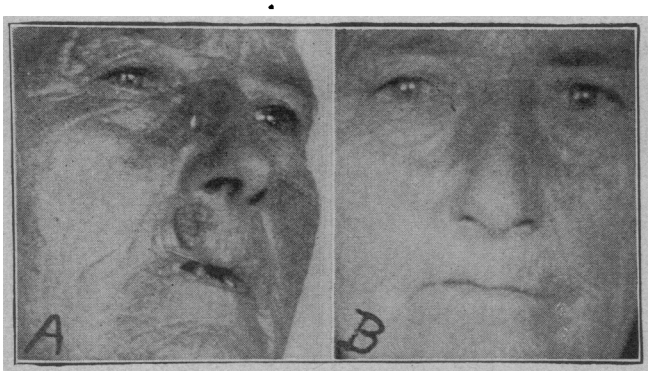

Fig. 1.—*A*, basal cell epithelioma of the upper lip in a woman, aged 72, referred by Dr. William Hamilton of Philadelphia. One desiccation treatment was given in September, 1914. *B*, result. Note absence of contracted scar. No recurrence in nearly four years.

sufficient to permit the destruction of a growth. A tongue may be coagulated to the base and then excised without hemorrhage.

In addition to the desiccation or coagulation of tissues and the sealing of blood and lymph channels, the heat penetrates beyond the area totally destroyed and devitalizes malignant cells without impairing the healthy tissue, thus lessening the likelihood of local recurrence or metastasis and conserving the maximal amount of normal tissue.

Blood vessels encountered in the oral cavity are blocked by the current, and secondary hemorrhage rarely occurs. The efficiency of electrothermic methods is increased in some cases by the judicious use of operative surgery, the roentgen ray and radium.

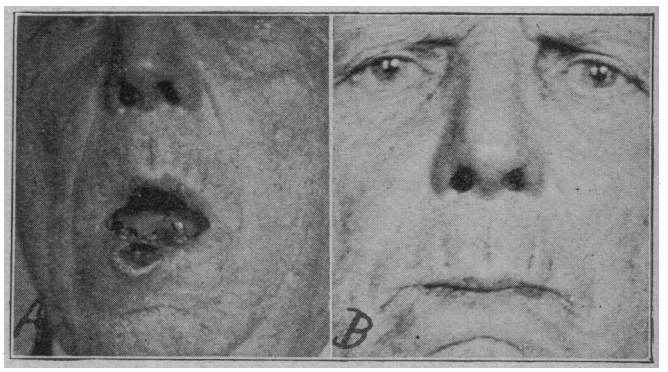

Fig. 2.—*A*, epithelioma of lower lip, a recurrence after surgical excision, in a man, aged 75, referred by Dr. Paul Cassidy of Philadelphia. One desiccation treatment under local anesthesia was given in April, 1915. *B*, result of treatment. Note absence of contracted scar and regeneration of lost tissue in lip. No recurrence in more than three years.

ELECTROTHERMIC METHODS

The methods to be considered are electrodesiccation and electrocoagulation. The desiccation method is one by means of which malignant growths of small or moderate size may be destroyed by the utilization of heat of just sufficient intensity to desiccate or dehydrate the tissues, and is produced by a monopolar high frequency current of the Oudin type, which is applied to the lesion by means of a steel needle or other pointed metallic applicator (usually steel knitting needles) which may be cut and curved, if necessary, to suit the case under treatment. The desiccation method is of advantage when the lesion is localized and a good cosmetic result is to be desired, and is subject to such control as to area and depth that a very small growth even on the cornea may be successfully treated without injury to vision, as may a growth on the vocal cords be destroyed without impairing phonation. The very slight trauma and absence of secondary inflammation probably explains the absence of scarring and the success obtained in treating delicate structures.

Electrocoagulation is produced by a bipolar high frequency current of the d'Arsonval type, is more penetrating and intense in action than the desiccation method, and is utilized to destroy large growths, including those that involve bone.

There are many variations of technic in the application of both methods to suit the requirements of the individual case, which need not be considered in detail here.[1] The heat from high frequency currents, unlike that from the thermocautery and galvanocautery, is not transmitted by contact, but is generated within the tissues by the resistance offered to the current. The

* Read before the Section on Stomatology at the Sixty-Ninth Annual Session of the American Medical Association, Chicago, June, 1918.

1. Pfahler, G. E.: Electrothermic Coagulation and Roentgenotherapy in the Treatment of Malignant Disease, Surg., Gynec. and Obst., December, 1914. Clark, W. L.: Electrical Desiccation as an Adjunct to Surgery, with Special Reference to the Treatment of Cancer, ibid., August, 1912; The Desiccation Treatment of Congenital and New Growths of the Skin and Mucous Membranes, THE JOURNAL A. M. A., Sept. 12, 1914, p. 925; Electrothermic Methods in the Treatment of Rodent Ulcer, Urol. and Cutan. Rev., November, 1917.

cautery is comparatively superficial in action, while the high frequency current under proper conditions will penetrate and destroy tissue to any depth, in parallel or divergent lines, depending on the size and arrangement of the electrodes, and also the strength and quality of current, which are varied to suit indications.

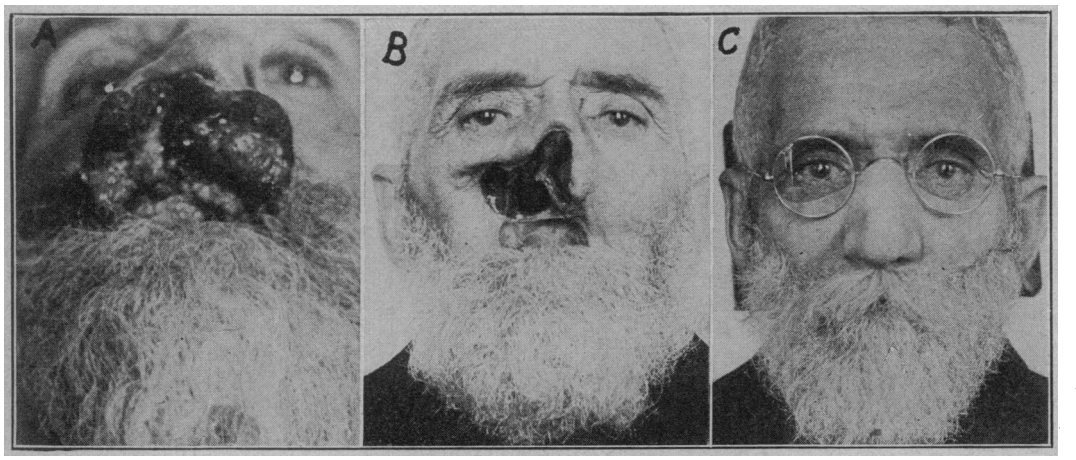

Fig. 3.—*A*, epithelioma involving upper lip, antrum, septum, nose, alveolus and hard palate, of three years' duration, in a man, aged 66, referred by Dr. J. D. Graber of Royersford, Pa. Previous treatment by plasters and the roentgen ray had been unsuccessful. The case was pronounced hopeless from a surgical standpoint by Dr. John Chalmers DaCosta of Philadelphia. One electrothermic coagulation treatment under ether anesthesia was given, March 1, 1916, and two slight recurrences were treated under local anesthesia by the desiccation method. *B*, final result, with no recurrence in two years and five months. *C*, reconstructed features by the sculpture method executed by Major R. Tait McKenzie of Philadelphia and Mrs. Alan Chesney of Baltimore. A plaster cast was made and the lost features built out in clay. A copper plate of suitable thickness was deposited on the cast by electrolysis and then silver plated. This plate was painted to match the tint of the skin, the mustache added and the plate attached to the rims of the glasses. A similar plate may be kept in place by means of spirit gum without the aid of the glass frames if desired. A plate is under construction to replace the hard palate and with artificial upper and lower teeth, in the hope that the patient may improve articulation and better masticate his food.

OPERATIVE SURGERY, THE ROENTGEN RAY AND RADIUM

When the antrum or other structures not easily accessible are involved, or when normal tissues cover the growths, operative surgery should be practiced as a preliminary to expose the lesion or to extirpate the gross mass of malignant tissue, followed immediately by the electrothermic treatment to check hemorrhage and to reach malignant tissue not possible to reach by the scalpel or bone-cutting instruments.

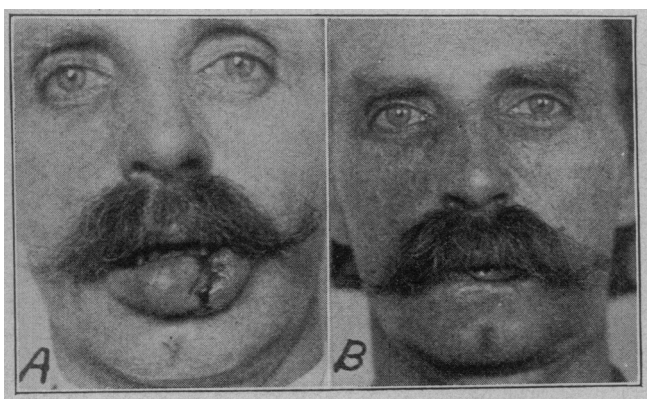

Fig. 4.—*A*, epithelioma involving the whole of the lower lip, in a man, aged 48, referred by Drs. G. C. Bird and J. F. Ulman of Philadelphia. One desiccation operation to the lip was performed under local anesthesia. *B*, result of desiccation treatment. Note absence of contracted cicatrix and regeneration of lost tissue. No recurrence in lip in four months.

When involved cervical glands are to be removed, excision must be practiced because it would be dangerous to work with the current near vital structures in the neck.

Before large growths at the base of the tongue, epiglottis, larynx or esophagus are treated, a tracheotomy should be done first and the larynx packed from below to prevent aspiration of toxic or other secretions. The ligation of the external carotid, and in rare instances the common carotid, may be practiced as preliminary to the treatment of some growths of the throat. Hemiplegia may occur, however, in the latter instance.

Deep, cross-fire roentgen therapy, according to standard technic, should be applied to the neck after dissection of the cervical glands, with the hope of preventing recurrence. When the glands are not involved, the roentgen ray should also be applied to them after electrothermic treatment of the primary lesion. The roentgen ray is of more value in the latter instance than in the former, as its use often prevents involvement of the glands, and when they are involved the roentgen ray will often retard the progress of the disease. Deep, cross-fire roentgen therapy may be used following electrothermic destruction at the site of the primary lesion to reach possible outlying cancer cells, as may radium, especially within the mouth; but the same area should never be treated by both the roentgen ray and radium. I have never seen any benefit result, however, from the use of the roentgen ray or radium alone in the treatment of cancer within the oral cavity, but the roentgen ray is of undoubted value as an adjunct to electrothermic methods and surgery.

CLINICAL OBSERVATIONS

Cancer of the mouth occurs more frequently in men than in women. The great majority of persons suffering from malignant lesions within the mouth have all their lives been insanitary or careless in the care of their mouth and teeth. Indifferent dental work or rough teeth causing continued irritation has been found to be a predisposing cause in many cases of mouth cancer, for the disease begins exactly at the site of the area which has been subject to a continued irritation.

Permanent bridge work and poorly fitting plates permitting the retention of food, and irritation to the gums are also factors in the development of malignant disease in the mouth. The removable bridge is best, and great care should be taken by dentists in properly fitting and adjusting plates.

Leukoplakia, papillomas, angiomas, chronic stomatitis, root abscesses and fistulas should be appropriately treated as a prophylactic measure against the development of malignant disease.

The irritation caused by excessive smoking is a contributory factor to the development of leukoplakia and mouth cancer, especially in those who fail to keep their mouth and teeth clean.

A striking number of mouth cancer patients are also syphilitic, and a combined tertiary lesion and cancer is not uncommon. This is true also of tuberculous lesions.

All papillomas or ulcers in the mouth showing a tendency to progress, unless the lesion is positively and purely syphilitic, should be treated just as though they were cancer, regardless of the pathologic finding, as all papillomas are potentially malignant.

A section should never be taken for pathologic examination except immediately before operation, if this seems necessary. A frozen section can be made and a diagnosis returned in ten minutes. By excising a piece of tissue for examination and waiting one or two weeks for a report, one will probably find that metastasis or rapid extension of the disease has taken place, owing to the opening of blood and lymph channels.

Before treatment is begun in any case of mouth cancer, a careful stereoscopic roentgenographic study should be made to detect possible bone or antrum involvement. Transillumination tests also should be made as a confirmatory diagnostic measure.

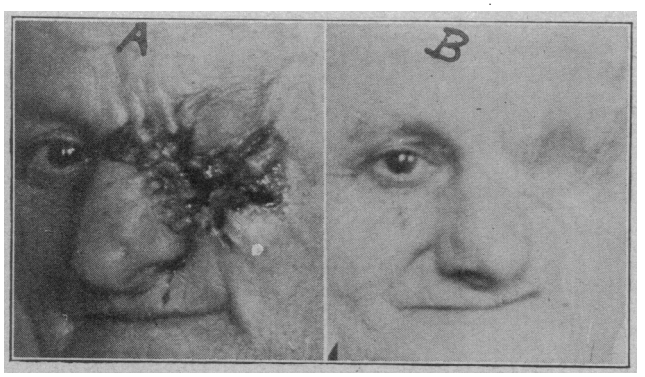

Fig. 5.—*A*, epithelioma involving nose, cheek, brow, eyelid, globe, and bones of orbit and antrum in a woman, aged 59, referred by Dr. T. L. Bradford of Philadelphia. Roentgen treatment had previously been used unsuccessfully. One intensive electrothermic coagulation treatment under ether anesthesia was given in March, 1917. *B*, result of one treatment. No recurrence in year and a half.

Success in the treatment of cancer is obtained only by absolute eradication of the last vestige of disease, else it will surely recur, and will progress more rapidly than if left alone.

Malignant lesions occurring in the mucous membranes are usually of the squamous cell type. They progress rapidly and metastasize early, in contradistinction to the basal cell or rodent ulcer type occurring on cutaneous surfaces, which progress slowly and seldom metastasize. If the mouth cases are localized and treated by electrothermic destruction and the cervical glands treated by the roentgen ray, a fair percentage of cases will be clinically cured.

The prognosis of cancer of the mouth with cervical glandular metastasis is always bad, no matter how early seen, yet a small percentage of patients recover after appropriate treatment, and it is worth while to attempt treatment when the glands are movable and not adherent. When the glands are adherent and other structures in the neck are involved, it is not worth while attempting treatment except for palliation. In early diagnosis and treatment lies the only hope.

Lip cases and small lesions within the mouth may be treated under local anesthesia; but if the lesion is advanced, general anesthesia should be employed to insure thorough destruction.

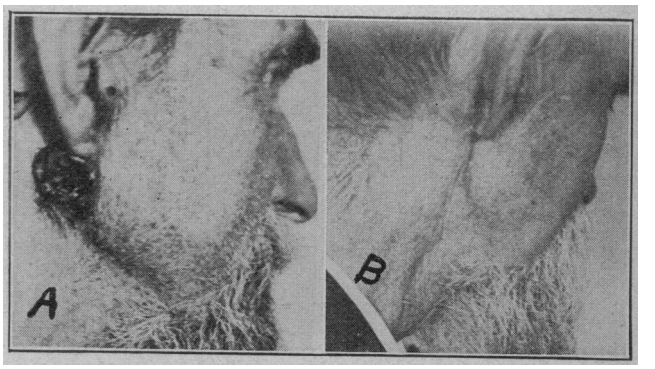

Fig. 6.—*A*, basal cell epithelioma, involving tissue and bone at angle of jaw, in a man, aged 73, referred by Dr. John Hedges of Philadelphia. The roentgen ray had previously been used without success. One desiccation treatment under local anesthesia was given in March, 1917. *B*, result of one treatment. Note absence of contracted scar. No recurrence in one year and a half.

ANALYSIS OF TWO HUNDRED CASES OF CANCER OF THE ORAL CAVITY, JAWS AND THROAT

Two hundred cases were treated by one or both of the electrothermic methods or in combination with surgery, the roentgen ray and radium. Surgery was used when the lesions were inaccessible to the current, when it required the incision of healthy tissue to expose the growth, or when it was necessary to excise the glands. In the majority of these cases the roentgen ray, radium or both had been used before without success, in which case these agents were not used again. When the roentgen ray or radium had not been employed before, one or both measures were used in combination with electrothermic methods, when judgment indicated the wisdom of so doing.

Two types of cases were selected for the series. First, those that were distinctly localized in which a guardedly favorable prognosis could be given, and second, those which had metastasized to the cervical glands, but the glands were movable and not adherent to the tissue of the neck, in which the prognosis was

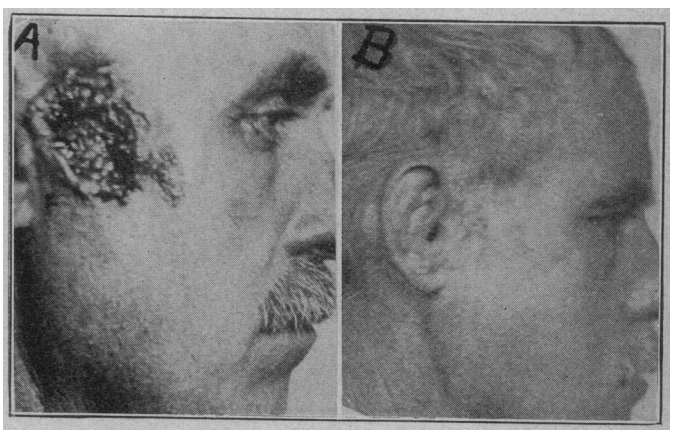

Fig. 7.—*A*, rodent ulcer involving bone of maxilla and mandible, of three years' duration, in a man, aged 50, referred by Dr. William H. Schmidt of Philadelphia. One electrothermic coagulation treatment was given under ether anesthesia in April, 1915. *B*, result. No local recurrence in eight months, when patient died with what was diagnosed as abscess of the brain by the attending physician, but which may have been metastasis.

unfavorable, but judgment indicated there was a chance of success if treated by combined measures.

Numerous other very advanced cases, in which the primary lesion was very extensive, with adherent metastatic glands, and involvement of other structures in the neck, were either declined as absolutely hopeless or else treated palliatively with no thought of cure, but sometimes to destroy a growth on the tongue or in the throat to ease temporarily the respiratory function or to render the intake of nourishment possible or more comfortable, and with the idea of alleviating pain and prolonging life.

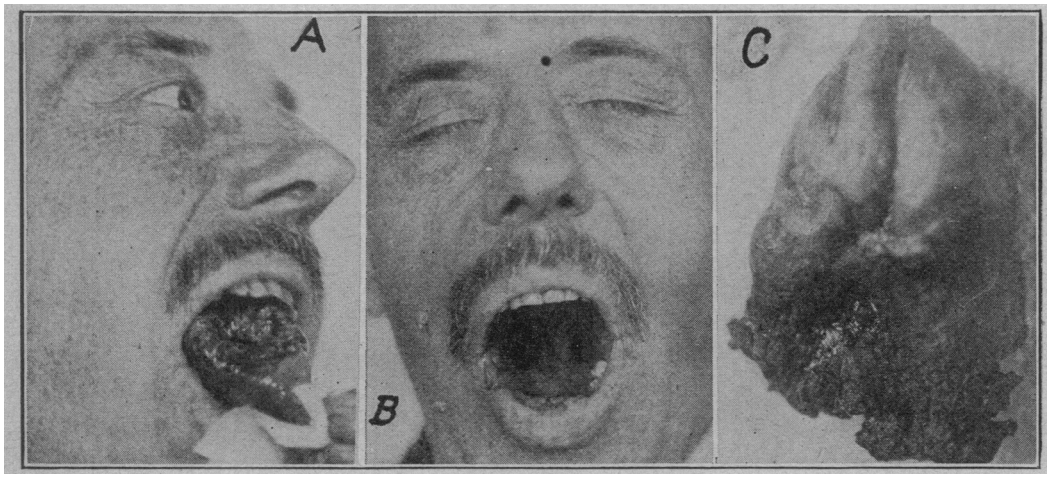

Fig. 8.—*A*, advanced squamous cell carcinoma of the tongue of four months' duration in a man, aged 46, referred by Drs. John B. Deaver and Walter Ziegler of Philadelphia. The cervical glands were involved and treated by the roentgen ray. The tongue was amputated at the line of the tonsils by the electrothermic coagulation method under general anesthesia, without hemorrhage. Little pain or discomfort followed the operation. *B*, result after electrothermic treatment. No local recurrence in two months. This photograph is shown to demonstrate the practicability of amputation of the tongue by the electrothermic method. *C*, tongue in another case immediately after amputation by this method. Note coagulated area at distal end.

The distribution of the cases treated and the results obtained are presented in the accompanying table. A brief outline is necessary to complete the presentation:

1. *Upper Lip.*—Localized: The nine cases of epithelioma of the upper lip, some of which were advanced, though without metastasis, were all treated once by the desiccation method, under procain-epinephrin anesthesia, and there has been no recurrence in from six months to four years.

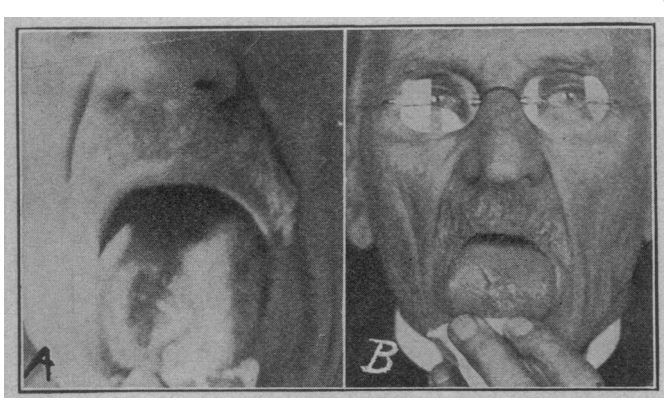

Fig. 9.—*A*, epithelioma of tongue of six months' duration in a man, aged 74, referred by Dr. J. C. Biddle of Fountain Springs, Pa. *B*, result of desiccation treatment under local anesthesia in May, 1911. There were enlarged glands on both sides of the neck in this case, which were probably inflammatory, since they disappeared after the treatment of the tongue lesion and the application of the roentgen ray to the neck. There was no recurrence in four and one-half years, when the patient died of some other disease.

2. *Lower Lip.*—Localized: The sixty-one localized lower lip cases were all treated under local anesthesia by the desiccation method. There has been no local recurrence in any case in from three months to eight years. In one case a cervical gland became involved two years after treatment of the lip and was excised by Dr. Charles Nassau of Philadelphia, with no recurrence in two years.

Metastasis: Of the three lower lip cases with glandular involvement, the primary lesion was treated by desiccation, and the glands were excised under the same anesthetization and the roentgen ray employed. There was no local recurrence in the lip in any case, but there was recurrence in the neck in two cases from which patients died. There was no recurrence in the third case either in lip or neck in two years.

3. *Alveolus (Upper Jaw) and Hard Palate.*—The thirteen cases involving the alveolus and hard palate were treated by the coagulation method under general anesthesia. In eight there was no recurrence in from three months to three years. Four recurred and were lost track of, while the other one is now under treatment again.

4. *Alveolus (Lower Jaw) and Floor of Mouth.*—Localized: Of the twelve localized alveolus and floor of mouth cases treated by electrocoagulation, six patients have remained well for periods of from three months to four years. Two had no local recurrence, but glands became involved, and four had both local recurrence and cervical metastasis.

CASES OF CANCER TREATED AND RESULTS OBTAINED

	Localized			Cervical Metastasis		
		Result			Result	
Anatomic Location	No.	No Recurrence	Recurrence	No.	No Recurrence	Recurrence
1. Upper lip	9	9	0	0	..	..
2. Lower lip	61	61	0	3	1	2
3. Alveolus (upper jaw) and hard palate	13	8	5	0	0	0
4. Alveolus (lower jaw) and floor of mouth	12	6	6	10	1	9
5. Tongue	15	10	5	6	2	4
6. Buccal surface	14	8	6	7	0	7
7. Antrum	2	2	0	0	0	0
8. Tonsils	5	3	2	2	0	2
9. Pharynx	2	1	1	0	0	0
10. Epiglottis, larynx, base of tongue and esophagus	3	0	3	0	0	0
11. Advanced lesions involving several structures in mouth	13	5	8	23	5	18

Metastasis: Of the ten cases involving the alveolus and the floor of the mouth with metastasis, only one patient has remained free from recurrence, and he has been well three years. Three remained well for periods of from three months to one year, but finally there was recurrence in the neck. In the remaining six, recurrence followed in a short time, and were soon beyond the hope of benefit.

5. *Tongue.*—Localized: Of the fifteen localized tongue cases, seven were treated by the desiccation method under local anesthesia, and eight by the coagulation method under ether anesthesia. There was no recurrence in ten cases in from three months to five years. Two recurred locally, and the glands became involved. These patients were treated again, but unsuccessfully. In three there was no local recurrence, but the glands later became involved. These patients reported too late for further treatment.

Metastasis: The six tongue cases with cervical involvement were treated by combined coagulation, surgery or the roentgen ray. One patient remained well for four and one-half years, when he died of some stomach trouble (Fig. 9).

Another has been well two years. Two had no local recurrence, but there was recurrence in the neck, and two had recurrence both in the tongue and in the neck. They were not treated again.

6. *Buccal Surface.*—Localized: Of the fourteen buccal surface localized cases, eight patients have remained well after electrothermic treatment for periods ranging from four months to four years. The other six cases recurred either locally or the glands became involved, and they were not treated again.

Metastasis: Of the seven buccal surface cases with glandular involvement, all recurred either locally or in the neck, and soon were beyond hope.

7. *Antrum.*—The two antrum cases were treated first surgically and then by electrocoagulation. There was no recurrence in one case in fifteen months and in the other in two years.

8. *Tonsils.*—Localized: Of the five localized tonsil cases, three have not recurred in from one to two years. Two had local recurrence and the glands became involved and could not be treated again.

Metastasis: Both cases recurred locally in the neck and were not treated again.

9. *Pharynx.*—One case soon recurred locally, but the patient is well three months after a second treatment. The other recurred locally and involved structures that were inaccessible and could not be treated again.

10. *Epiglottis, Larynx, Base of Tongue and Esophagus.*—These three cases were all unsuccessful. One patient died of pneumonia a few days after treatment, probably owing to aspiration of secretions, a preliminary tracheotomy not having been performed. The second patient died of secondary hemorrhage two weeks later. There was recurrence in the third case, and a second operation was not attempted.

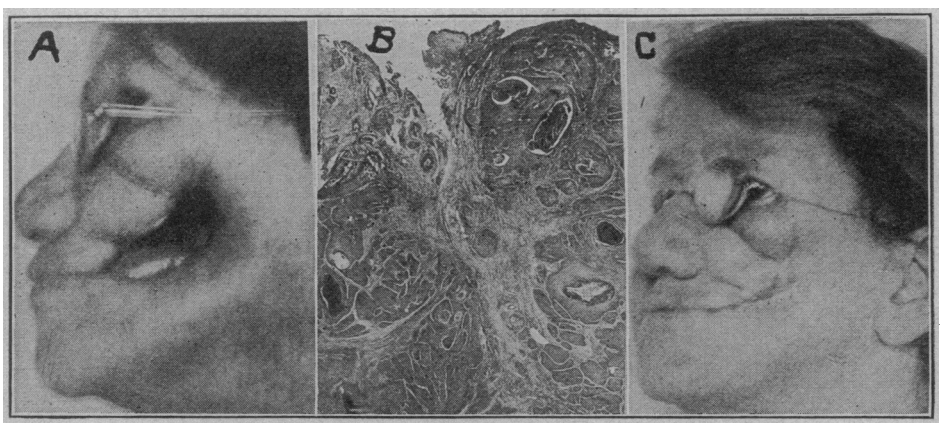

Fig. 10.—Squamous cell carcinoma involving antrum, alveolus, hard palate and buccal surface on left side in a woman, aged 60, referred by Dr. E. B. Miller of Philadelphia. Since involvement was extensive in this case and some of the diseased tissue was inaccessible, preliminary surgical removal was done by Dr. G. M. Dorrance, followed immediately by electrothermic treatment. *A*, result of this treatment. No recurrence in fifteen months; *B*, low power photomicrograph (showing prickle cells) on which diagnosis was based; *C*, result of plastic operation in which tissues were separated from bony attachments, and cheeks drawn together and sutured.

11. *Advanced Lesions Involving Several Structures in Mouth.*—Localized: Five of these thirteen patients have remained well for periods ranging from three months to two years. In the remaining eight cases there was local recurrence, and the glands became involved, rendering them hopeless.

Metastasis: Of these twenty-three cases, five remained free from recurrence from three months to one year. The others all recurred and soon were beyond hope of benefit.

When the lesions recur only locally, there is a chance of success if the patient is treated a second or, indeed, a number of times; but if there is recurrence in the glands of the neck, further treatment is usually of no avail.

The basal cell, or rodent ulcer, type of epitheliomas occurring on cutaneous surfaces, even though advanced and with bone involvement, is so satisfactorily treated by the desiccation and coagulation methods, that these lesions practically all recover when treated thoroughly.

It will be seen that the chances of success in cancer of the oral cavity vary with localization, the anatomic location and the presence or absence of glandular involvement.

The foregoing analysis of results obtained in 200 cases, and the illustrations, will serve to give an idea of the rôle the desiccation and electrothermic coagulation methods can be expected to play in the treatment of cancer of the oral cavity, jaws and throat, and in which types of cases the use of operative surgery, the roentgen ray and radium in combination is justifiable.

Medical Arts Building.

THE USE OF HEAT AND RADIUM IN THE TREATMENT OF CANCER OF THE JAWS AND CHEEKS*

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Cancer of the jaws and cheeks is one of the most malignant forms of new growth. The type that is primary in the cheek is probably only exceeded in its malignancy by the melano-epithelioma. Little is known regarding the causation of such growths except that chronic irritation of some sort is believed to be an important factor, and, this being true, every snag of tooth or any other source of irritation should be eliminated from the mouth as a prophylactic measure. While tobacco may be a cause in some cases, it probably has not so much importance as is usually attributed to it. The man with cancer of the cheek who chews tobacco has, as a rule, carried the tobacco on the unaffected side of the mouth. Syphilis is undoubtedly a factor in the production of cancer of the tongue, but is of no demonstrable consequence in relation to cancer of the jaw and cheek. Papillary leukoplakia frequently develops into epithelioma, and it should be thoroughly treated with cautery and radium.

Fifty-seven cases of cancer of the jaws and cheeks were examined at the Mayo Clinic during 1917. Thirty-two of the patients were inoperable; four had glandular involvement, but operation was considered advisable and a block dissection was done in addition to the treatment of the local growth. Twenty-one had no glandular involvement and were treated with the cautery and radium. Data concerning these twenty-one patients form the basis of this paper. In most instances epitheliomas occurred in the fifth decade. There were two patients between 31 and 40 years of age; four between 41 and 50; twelve between 51 and 60, and three between 61 and 70. Nineteen were men

* From the Mayo Clinic.

* Read before the Section on Stomatology at the Sixty-Ninth Annual Session of the American Medical Association, Chicago, June, 1918.