the root. The sulcus is thus seen to be a cleft left by the splitting away of gum epithelium from Nasmyth's membrane. When the gum epithelium has split clear away from the whole length of the tooth-crown, or where it never has united with Nasmyth's membrane, it may take a more or less extensive attachment to the root of the tooth (to the cementum).

Thus, though technically there is a breach of epithelial continuity where the attachment of gum to tooth has receded beyond the enamel, practically there is no breach in the defence till the enamel has been worn through to the dentine (by caries or attrition) or till disease (pyorrhoea) has destroyed the epithelial attachment to the tooth.

The nature of the epithelial prolongation which provides for epithelial attachment to the tooth-root is worth further notice.

It is not always present (Fig. 8), and in such cases, if it be due to develop later, it must be provided by the gum epithelium, as was probably the case in Fig. 7, where the gum epithelium can be seen gradually losing its papillary character as it passes along the root. In many cases, however, it seems to have been provided for from the beginning. Most of my sections of this point are taken from temporary teeth, and it is worthy of note that there is no difference in extent of prolongation between teeth about to be shed and those of earlier age (Figs. 3 and 6). There is thus no evidence in the temporary teeth of "continuous eruption." Fig. 7 shows epithelium whose gum origin is indicated by the gradual fading away of the papillary structure; but Figs. 3 and 6 from temporary teeth, and Fig. 2 from a permanent molar, suggest a different origin. A higher magnification (Fig. 4) of the prolongation strongly suggests stellate epithelium—a form of epithelium more likely to arise from epithelium originating from the enamel organ than from the gum. As Figs. 8 and 9 show, there is at the time of eruption an epithelial lining to the tooth-crypt derived from the outermost epithelium of the enamel-forming organ. To allow gum epithelium to take attachment to the tooth this epithelial lining must either atrophy or blend with the gum. I have not been able to decide which, but am inclined to think it generally atrophies, except at its periphery, where it remains capable at need of further growth.

THE HEALING OF GASTRIC ULCERS: RADIOLOGICAL OBSERVATIONS.

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(With Special Plate.)

THE radiological diagnosis of ulcers of the stomach dates from the classical description by Haudek¹ of the characteristic "niche" seen in the outline of the stomach after an opaque meal. Much interest has been attached to the disappearance of this "niche" under treatment, and many papers have recently appeared on the subject of the "healing" of gastric ulcers. The terms "healing" and "healed" with reference to gastric ulcer are open to a certain amount of criticism; but it must be accepted that disappearance of a "niche" associated with clinical improvement, disappearance of pain and tenderness, disappearance of occult blood from the stools and vomit, gain in weight, must certainly indicate a healing process, as Hamburger² has pointed out. If the healing process continues and no recurrence takes place over a period of, say, two years, many observers would consider such cases as "healed." There is certain histological evidence to support this view, and the matter is more fully discussed later.

During the past two years we have investigated a group

of cases by means of repeated opaque meals, and in this paper we deal with the results. Seventeen cases were selected in which x-ray examination disclosed a definite "crater" on the lesser curvature of the stomach. Certain cases occurring at the time when this investigation was commenced, in which an ulcer was present on the anterior or posterior wall of the stomach, have not been included, since it was found that unless an ulcer could be shown in profile in a skiagraph it was very difficult to estimate any change in size at subsequent examinations. The cases included in-patients and out-patients, but in many instances the attendance of the latter for treatment was very irregular, and no deductions as to the success or failure of medical treatment are made in this paper, nor should such deductions be legitimately made on the evidence put forward.

The "double meal" method has been employed. Two nights before the examination an ounce of castor oil is given, and the evening before a light meal is allowed. Six hours previous to the time arranged for radiography three ounces of barium sulphate are given well mixed with bread-and-milk.

At the screen examination notice is taken of the position of the head of the meal and whether a gastric residue is present or not. Occasionally there has been a residue of barium in an ulcer crater. Next a mouthful of thick barium emulsion is administered, and this is used to "whitewash" the whole of the stomach according to the method described by Scott.³ After a careful examination of the whole of the stomach by this method the patient continues to take barium emulsion until the stomach is filled. The patient is then rotated, and the stomach examined from all angles. A skiagram is taken at that angle which shows the maximum size of the crater with the minimum of distortion. At the re-examination great care is taken that the distance between target and plate, and the position of the patient, are the same.

Results.

Of the 17 cases in this series all were examined on two occasions, and 15 on three occasions, the intervals between the examinations varying from one week to one year.

TABLE I.—Results of First Re-examination (17 cases).

(1) "Healed." No evidence of ulceration ...	11
(2) "Healing." Definite decrease in size of ulcer...	4
(3) "Stationary." No alteration in size ...	2

Average period elapsed since primary examination, six months.

The 11 cases in which no ulcer crater could be seen were all clinically free from symptoms, and in good health. The 4 cases in which the ulcer crater was smaller in size were all improving, although the patients were not altogether free from pain. In one of these cases, although the "niche" on the lesser curvature had disappeared, there was a persistent incisura opposite to the original site of the ulcer and symptoms were still present suggesting that healing was not complete.

TABLE II.—Results of Second Re-examination.

(1) No x-ray evidence of presence of ulcer in 11 cases, made up as follows:	
"Healed" cases without recurrence ...	6
"Healing" cases now "healed" ...	4
"Stationary" case now "healed" ...	1
(2) Ulcer again present ("healed" cases now relapsed) ...	4

Two cases did not attend; one shown as "healed" and the other as "stationary" in Table I.

Average period between the two re-examinations—three and a half months.

It will be seen from this table that in 4 cases reported as "healed" in the first examination definite relapse had occurred. The clinical symptoms and signs had reappeared in all these patients, although at the time of the first re-examination, when no ulcer crater was seen, all these 4 cases were clinically free from symptoms. In one of these cases the ulcer crater was definitely larger than before. Of the 11 cases reported as "healed" in Table II, 6 represented patients in whom the ulcer had remained healed over the whole period of investigation, and the others those in

whom "healing" had progressed satisfactorily between the two re-examinations.

In view of the great variability in the rate of healing present in this series of cases, quite apart from any question of special treatment, the results were further analysed with regard to length of history, since it might be expected that only ulcers with a short history would heal quickly or at all.

TABLE III.—Results in Relation to Length of History.

Group 1.	
Cases found "healed" at both re-examinations ...	6
Length of history—9, 8, 6, 4, 1 (years), 6 months.	
Group 2.	
Cases found "healed" at first re-examination which were found relapsed at the second re-examination ...	4
Length of history—15, 4, 4 (years), 9 months.	
Group 3.	
Cases with ulcer still present at first re-examination which were "healed" at second re-examination ...	5
Length of history—10, 3, 1, 1 (years), 4 months.	

These figures indicate that in our series of cases the healing of an ulcer has very little, if any, relation to the length of a patient's symptoms. It will be seen that the longest "history" in this series was fifteen years, and the shortest four months.

COMMENTARY.

The results here described confirm the value of x-ray examinations to check the healing of gastric ulcers. The ulcer may disappear very quickly; in one of our cases examined at weekly intervals it was no longer visible at the end of four weeks (Fig. 1). In another very striking case a huge crater suggestive of a malignant ulcer was discovered on radiological examination. At a subsequent laparotomy the large mass then found was so adherent to surrounding structures that the case was considered unsuitable for surgical removal. On a second radiological examination four months later there was no sign of a crater and the stomach appeared normal (Fig. 2). The "base" of the ulcer shadow was measured in each of our cases, and ranged from 3.5 cm. to 0.5 cm. In this series the size of the ulcer appeared to have very little connexion with the question of whether it would heal or not.

Healing and recurrence have taken place without any sort of treatment in patients who refused to attend regularly, and the "natural periodicity" of the peptic ulcer, as it has been called, has been very well shown. An important point arises from this with regard to the period at which a patient is submitted to radiological examination. By keeping careful clinical records of the patients here described we have found that as a rule pain disappears as the ulcer heals, but it is often gone before the complete disappearance of the crater. Also pain tends to reappear in a patient with recurrence before the ulcer can be shown on radiological examination. Consequently a negative x-ray examination between two "attacks" of gastric ulcer or even at the beginning of an attack must not be taken to exclude the existence of an ulcer.

Possible Fallacies.

In reading the literature on the healing of gastric ulcers we have been impressed with the possibility of certain fallacies with regard to the disappearance of the "niche."

Hamburger² has pointed out that when the "niche" on the lesser curvature disappears it probably means that scar tissue has filled up the ulcer crater. He holds, therefore, that disappearance of the "niche" and improvement in the clinical condition must occur together and be maintained for six months to two years before the cases are to be regarded as cured. In one group of his cases the "niche" disappeared, but peristaltic waves failed to pass over the ulcer area, indicating that a pathological condition was persisting.

The "niche" may possibly appear smaller because it contains food, as pointed out by F. W. White,⁴ or mucus, as stressed by Hollander,⁵ but we think that this source of fallacy is largely overcome by the use of the "double meal" technique, since we believe that the first meal acts as a cleanser of the stomach and there is much less risk of

mucus or food debris being present in the floor of the ulcer when the second meal is given six hours later. White further stresses the importance of taking all the x-ray pictures from the same angle, a point to which we have paid attention. Hollander is inclined to doubt the value of the disappearance of the "niche" as an indication of healing, on account of one case in which healing was reported but haematemesis occurred soon afterwards, and a large chronic ulcer was found at operation. He suggests that an ulcer crater may possibly be obliterated by the pressure of surrounding organs. The probability in such a case is, however, that clinical signs and symptoms would still be present.

A paper on gastric ulcer by Büscher⁶ contains certain interesting points in connexion with healing. This paper deals with 643 cases and is a study of the pathology and treatment of the condition. The author states emphatically that radiological observation of the disappearance of the "niche" during treatment is a most valuable estimation of the success of treatment. He stresses certain necessary precautions in technique, but in his wide experience he has not met with many cases where an error was made. Büscher points out, however, that the "niche" may disappear and quickly recur, so that in exceptional cases, such as that reported by Hollander with haematemesis after "healing," an ulcer reported as "healed" may be found at operation. Two recent papers by Crohn, Weiskopf, and Aschner⁷ give support to the value of radiological evidence of "healing" of an ulcer. In the first of these they describe a group of 20 cases kept under constant clinical observation. They point out that certain mistakes may be made; a false impression of a "niche" may be produced by persistent peristaltic waves overlying shadows of barium-filled intestines, perigastric adhesions, or localized spasms. They believe, however, that the percentage of errors is very small, and that most objections are theoretical. They point out that whether disappearance of a "niche" means a fully healed ulcer, or the temporary filling of a crater with granulation tissue, can only be settled by examination of a stomach removed at operation from a case in which the "niche" has been shown to have disappeared.

In their second paper they deal specifically with this point, describing two cases of gastric ulcer operated upon. In one of these healing of the ulcer was far advanced, and definitely in progress in the other. Such healing had been associated in these two cases with the regression of subjective clinical symptoms, and the objective evidence of subsistence of the "niche" formation found radiologically. This evidence confirms the previous clinical evidence as to the value of x-ray examinations for observing the healing of gastric ulcers, and justifies the conclusion that radiological investigation of "healing" is a most valuable method.

SUMMARY.

1. Seventeen cases of gastric ulcer showing a crater on the lesser curvature have been observed radiologically and clinically over a period of two years.

2. The disappearance and reappearance of the characteristic "niche" have been observed and were associated with remission and recurrence respectively of clinical symptoms and signs.

3. No relation was found either between the length of history or the size of an ulcer and the rate or permanence of healing.

4. Certain fallacies are discussed, but on the whole x-ray evidence of healing appears to be of great value.

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FIG. 1, A.—Ulcer crater on lesser curvature (November 19th, 1926).

FIG. 1, B.—Ulcer crater smaller (November 25th, 1926).

FIG. 1, C.—Ulcer crater still smaller (December 2nd, 1926).

FIG. 1, D.—Ulcer crater has disappeared (December 16th, 1926).

FIG. 2, A.—Large ulcer; confirmed at operation (November, 1925).

FIG. 2, B.—No x-ray sign of ulcer (March, 1926).