for fifteen years. The eyeball was protected by lead-foil through a small hole in which the growth protruded. Three applications of three-quarters of an hour each, with intervals of one week, resulted in the growth entirely disappearing without ulceration or inflammation. This case is interesting, although not coming under "diseases of the nose and throat."]

THE VISUAL FIELDS IN ANTERIOR NASAL SINUSITIS.

By G. F. C. Wallis, M.D.Edin.,
Shrewsbury.

Recently in this Journal[1] I described the visual field anomalies associated with suppuration in the spheno-ethmoid group of accessory sinuses. In this paper those changes observed in twenty-three cases occurring in disease of the fronto-antro-ethmoid group are recorded.[2]

Observations extending over two years have been made upon forty-four patients suffering from sinusitis, the posterior group (previously published) being affected in 33 per cent., the anterior in 47 per cent., and both groups in 20 per cent. In suspected sinusitis the visual fields were examined wherever possible, and with few exceptions before any nasal treatment was attempted. Investigations were again made at intervals during progress, but not on the same day of any therapeutic measure, nor in females during menstruation. The same size and colour test-objects were always used, excepting when any visual defect was extreme. The peripheral field was tested with 5·0 mm. squares of white, red and green, and central vision by 1·0 mm. squares of red and green. Perimetric records were always made in good diffuse daylight. If, in the presence of contraction of the colour fields alone there was any reason to suspect defective colour-perception, Holmgren's wools were used to elucidate this point. In anterior sinusitis the diagnosis of the nasal condition presents less difficulty than in the posterior group, and as most of the cases were ultimately confirmed by operation, details have only been mentioned where necessary. In this paper the term "concentrically contracted" refers to a field which has the same form or shape as a normal field, only smaller; "generally

[1] Journ. of Laryngol., Rhinol., and Otol., May, 1911, p. 242.

[2] Two cases are also included in which there was posterior sinusitis as well, the anterior group, however, being more extensively affected.

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contracted" to a field in which the whole is involved, but a portion more so than the rest.

Cases 1 to 5, 10 to 12, and 17 to 21 inclusive were observed in Dr. Watson-Williams's Clinic at the Bristol Royal Infirmary; 15 and 16 were under Mr. C. H. Walker in the Ophthalmic Department of the Bristol General Hospital; and 6 to 9 inclusive, 13, 14, 22 and 23 under Mr. Russ Wood at the Shrewsbury Eye and Ear Hospital.

Antral Suppurations.

(1) Ellen C——, aged fifteen. Chronic bilateral antral sinusitis, with recurrent polypi; duration two years. R.V. and L.V. $\frac{6}{6}$; marked hippus; fundi healthy. *Visual fields* (before and after successful sinus treatment).—Right and left: Normal for white and green. The diagnosis in this and Cases 2 and 3 was confirmed at the subsequent Watson-Williams radical antra operations.

(2) Elsie G——, aged twenty-one. Chronic bilateral antral sinusitis, with recurrent polypi, and probable sphenoid suppuration. R.V. and L.V. $\frac{6}{6}$; asthenopia; esophoria; slight hippus. *Visual fields* (before treatment).—Right: Concentric contraction for all colours—white, 10°; red and green, 20°. Left: White genera, contraction, 10°, but 40° in temporal field; red and green general contraction, 20° and 30° temporal. There is partial reversal for red and green in both eyes, but she presents no hysterical stigmata. *Visual fields* one week after operation were more contracted. Three months later (in spite of presence of pus in both superior meatūs) the white are normal, red and green remain unchanged.

(3) Mrs. A. P——, aged thirty-nine. Chronic right antral sinusitis, with polypi; many years' duration. R.V. $\frac{6}{5}$; dacryocystitis. L.V.: blind with traumatic retinitis proliferans. *Visual fields.*—Right: White normal; concentric contraction for red 15° and green 20°, very slightly more in temporal fields. *Visual fields* (one month after successful sinus treatment), no improvement; considerable neurosis.

(4) Joseph T——, aged fifty-eight. Chronic bilateral antral sinusitis, possibly polysinusitis; duration five years. R.V. and L.V. $\frac{6}{5}$; right dacryocystitis. *Visual fields.*—Right and left: Practically concentric contraction; white, 5°–10°; red and green, 25°–35°. Treatment refused by this and Case 5, and patients lost sight of. The diagnosis in this and Case 5 was confirmed by Lichtwitz exploratory puncture.

(5) George S——, aged twenty-five. Chronic left and probable right antral sinusitis; duration four years. R.V. + 7·5 = $\frac{6}{18}$; L.V. + 3 = $\frac{6}{5}$; insufficiency left inferior oblique. *Visual fields.*—Right and left: White concentric contraction, 5°–10°; red and green general contraction, 15°–25°; slightly more marked in the superior temporal quadrants. Partial reversal of red and green in the left but the patient is of phlegmatic type.

(6) Ruth E——, aged thirty. Chronic right antral sinusitis; duration eight years. R.V. and L.V. $\frac{6}{6}$. *Visual fields* (before operation).—Right: White normal, green general contraction 7°. Left: White and green normal. *Visual fields* (after operation).—Right: In spite of successful treatment, white and green four months later were more contracted. Left normal. There was no neurosis. Diagnosis in this and Case 7 was confirmed at a radical nasal operation.

(7) Ellen R——, aged twenty-two. Chronic right antral sinusitis; duration four years. R.V. and L.V. $\frac{6}{6}$. *Visual fields.*—Right similar to Case 7. Left normal.

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(8) Charles W——, aged twenty-five. Left recurrent acute antral sinusitis. R.V. and L.V. $\frac{6}{5}$. Eyes normal, no central scotoma. *Visual fields* (during attack).—Right: Normal for white and green. Left: White normal, green concentric contraction 20°. *Visual fields* (after attack).—Right: White and green normal. Left: White and green very slight concentric contraction. *Diagnosis.*—A radical antral operation had been performed seven years previously for chronic sinusitis, and the suppuration cured, but the patient remained liable to acute attacks.

(9) Henry B——, aged thirty-seven. Acute left antral sinusitis, with necrosis of the hard palate. R.V. and L.V. $\frac{6}{5}$. Fundus normal; no central scotoma. *Visual fields* (before treatment).—Right: White and red normal. Left: White and red contracted 10° in the temporal quadrants, but elsewhere normal. *Visual fields* three months after recovery were full.

Frontal Suppurations.

(10) Harry P——, aged thirty-two. Bilateral chronic frontal sinusitis; duration eleven years, very severe cephalalgia. R.V. $\frac{6}{12}$, L.V. $\frac{6}{9}$. Asthenopia; moderate hippus; green blind. *Visual fields* (a Killian had been performed a year previously on the right sinus, curing the suppuration).—Right and left: Concentric contraction for white 5°–12° and red 30°. *Visual fields* (one month after operation on left sinus, when considerable suppuration still present).—No change. The diagnosis was confirmed at the operation (Watson-Williams osteoplastic flap) on the affected sinuses in this and Case 11.

(11) Sidney B——, aged twenty-eight. Chronic bilateral frontal sinusitis with expansion of the anterior wall; duration five years. Intense cephalalgia. The sinuses were enormously extensive, both laterally and antero-posteriorly. R.V. $\frac{6}{8}$, L.V. $\frac{6}{5}$; asthenopia. *Visual fields* (before operation).—Right: White concentric contraction 5°; green general contraction 20°, but temporal 40°. Left: Concentric contraction for white 5° and green 20°. *Visual fields* (one month after operation when suppuration and symptoms ceased). No change.

(12) Mrs. H——, aged twenty-nine. Chronic bilateral frontal, right antral and possibly right sphenoidal sinusitis; duration four years. R.V. $\frac{6}{5}$, L.V. $\frac{6}{12}$. Bilateral hazy neuritis; hyperphoria. *Visual fields* (two years after successful treatment of right antral sinusitis by a Watson-Williams radical operation). Right: Concentric contraction white 5°–10°, red 15°–20°, and green 30°. Left: General contraction, white 20°–30°, red and green 30°–40°, slightly more superiorly and inferiorly. *Visual fields* (two months after Watson-Williams osteoplastic flap on both frontals).—Right and left: Present the same characters, but all colours 5°–10° more extended. Diagnosis was confirmed at the operations.

(13) Elsie N——, aged twenty-one. Right subacute traumatic frontal sinusitis. R.V. $\frac{6}{6}$, L.V. $\frac{6}{5}$. Very marked hippus, no central scotoma. *Visual fields.*—Right: White and green general contraction 30°, but temporal 45°. Left: Concentric contraction for white and green 20°. *Visual fields* (after treatment).—Right: Very considerable extension for white and green. Left: Practically full. The marked hysterical element accounts for the contraction in the left, and not a little of the right. *Diagnosis.*—The history of a severe blow over the right brow followed by unconsciousness, and later by constant frontal headache and blood-stained discharge from the right nostril. The right middle turbinal is hypertrophied, and pus in the middle meatus. The antra and left frontal sinuses transilluminate well, but the right frontal defectively. The symptoms subsided after hemi middle turbinectomy.

(14) Sarah D——, aged sixteen. Left acute frontal sinusitis; enormous

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œdema left eyelids and forehead. R.V. and L.V. $\frac{6}{6}$. No proptosis; no central scotoma. *Visual fields* (taken after subsidence of œdema).—Right: Concentric contraction for white and green 20°. Left: White and green general contraction 30°, but temporal 40°, with complete reversal of red and green. *Visual fields* (after treatment).—The left was now as extensive as the right, but concentric contraction of 25° still present. The marked hysteria accounts for the reversal of colours, and not a little of the contraction in both eyes. *Diagnosis.*—Severe frontal pain set in after a "cold." Much œdema and tenderness of left forehead and eyelids. No pus in the nose, but enlargement of the left middle turbinal. Transillumination of left frontal sinus poor. The symptoms subsided in a few days after leeching the forehead and nasal septum, and a hemi middle turbinectomy.

(15) Henry B——, aged sixty-five. Left frontal mucocele; duration twenty years. R.V. $\frac{6}{9}$, L.V. $\frac{6}{6}$. Very marked proptosis forwards, outwards and downwards. Left pupil is 35 mm. from mid-line, and the right 31·5 mm. Fundi normal. *Visual fields* (before and after operation).—White and green normal. Diagnosis was confirmed at the subsequent modified Killian operation.

Anterior Ethmoid.

(16) John T——, aged fifty-four. Right ethmoidal mucocele perforating the lachrymal bone and tracking forward sub-periosteally, presenting a large ovoid swelling at right inner canthus. R.V. and L.V. $\frac{6}{9}$. Eyes healthy. *Visual fields* (before and after operation).—Right and left: White and green normal. Diagnosis confirmed at operation.

Polysinusitis.

(17) Frank S——, aged thirty-four. Chronic left pan-sinusitis: duration six years. R.V. - $3\frac{6}{12}$. L.V. - $4\frac{6}{18}$. *Visual fields* (taken at intervals three months after operation when the nose was practically free from pus).—Right: White, red, and green concentric contraction 20°–30°, but a little more in the superior temporal field. Left: Extreme general and temporal contraction—white and green being within the 20° circle. Post-operative debility explains some of the contraction observed. Diagnosis was confirmed at the operations. At different dates Watson-Williams operations were performed on the frontal antral and sphenoid sinuses.

(18) Reginald C——, aged fifteen. Chronic bilateral, antral, and sphenoidal sinusitis; duration one year. R.V. and L.V. $\frac{6}{6}$; bilateral hazy neuritis; marked hippus; esophoria. *Visual fields* (before operation).—Right: White, slight general contraction, but 20°–25° in the superior temporal quadrant; red and green concentric contraction 25°–35°. Left: The fields are similarly affected, but more contracted. *Visual fields* (three days after operation).—Right and left: White are practically normal, and red and green extended 10°–15°. The neuritis has subsided. *Diagnosis.*—Confirmed at operation (Watson-Williams radical antral). After the polypi had been removed and the antra freed from suppuration, pus was repeatedly seen in the superior meatus. The neuritis was dependent on the sphenoidal sinusitis; the relief following the removal of polypi was probably due to a more free escape of pus from the posterior sinuses.

(19) Euphemia H——, aged thirty-three. Chronic bilateral, frontal, and antral sinusitis; duration five years. R.V. $\frac{6}{6}$; L.V. $\frac{6}{9}$. *Visual fields* (one year after operation, the sinuses free of pus).—White contracted in right 30° inferiorly,

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and in left 15° superiorly and 25° inferiorly; red and green concentric contraction 25° in both. The diagnosis was confirmed at the operations (Watson-Williams osteo-plastic frontal and radical antral operations) in this and Case 20.

(20) Mary H——, aged twenty. Chronic bilateral, frontal, and antral sinuses; duration six years. R.V. and L.V. $\frac{6}{6}$. Asthenopia; moderate hippus. *Visual fields* (before treatment).—Right and left: White normal, green contracted superiorly 10°–15°, and inferiorly 15°–20°. No opportunity presented for examining the fields after treatment (Watson-Williams osteo-plastic and radical antral operations).

(21) Mrs. S. A——, aged thirty. Acute bilateral, frontal, and antral sinusitis. R.V. and L.V. $\frac{6}{5}$. No central scotoma. *Visual fields* (during attack).—Right and left: Concentric contraction, white 5°–10°, red and green 20°. Partial reversal of the two latter. No hysterical stigmata. *Visual fields* on recovery normal. *Diagnosis.*—She was seen on two occasions during an attack, the first of which, being post-influenzal, œdema and redness of the forehead and cheeks were present, the middle turbinates were engorged, and there was pus in both middle meatūs.

(22) Charles W——, aged sixty-eight. Chronic polysinusitis and subsequent malignant growth in right antrum. R.V. and L.V. $\frac{6}{24}$; optic atrophy; right dacrocystitis. *Visual fields.*—Right: White temporal contraction 20°. Left: White general contraction 20°, and temporal 60°. Green is contracted within the 15° circle in both fields. The fields became progressingly more affected in this and in Case 23.

(23) John T——, aged seventy-three. Right and left polysinusitis; many years' duration, with subsequent development of inoperable malignant disease in the right antrum. R.V. and L.V. $\frac{6}{6}$. *Visual fields.*—Right and left: Present similar contractions to those in Case 22, though to a less extent.

Résume.

Nine Antral Suppurations.

No. of cases.	Character of field.	No. of cases.	Effect of treatment on field.	
1.	Normal.	1.	Normal before and after.	
2.	White normal; marked concentric contraction for colours.	2.	(Acute sinusitis.) Recovery to normal.	Sinus treatment successful.
3.	Concentric contraction for all colours.	1.	Considerable extension.	
2.	General contraction, more in temporal.	1.	No change.	
1.	Slight temporal contraction.	2.	Slightly more contracted.	Treatment in one of these not successful.
	In two of these partial reversal of colours; central scotoma not present.	2.	Treatment not permitted.	

Five Frontal Sinusitis.

3.	Chronic suppuration. Two cases concentric contraction, one general.	2	(Chronic.) No improvement.	Sinus treatment successful.
2.	Acute suppuration. General contraction, slightly more in temporal.	1.	(Chronic.) Improvement.	
	Central scotoma not present.	2.	(Acute.) Rapid improvement.	

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Two Mucoceles.

No. of cases.	Character of field.	No. of cases.	Effect of treatment on field.
2.	Normal fields.	2.	Normal fields.

Eight Polysinusitis.

2.	Concentric contraction.
3.	General contraction, more in temporal.
3.	Altitudinal.
	In one of the above, partial reversal of colours. Central scotoma not present.
2.	Improved. Sinus treatment successful.
2.	Only seen after operation. Sinus treatment unsuccessful in one.
2.	Inoperable malignant disease.
1.	Not seen after treatment.

In my former article dealing with the occurrence of field affections in cases of spheno-ethmoid sinusitis, I laid stress upon some change being present in every case. With three exceptions this is true for the fronto-antro-ethmoid group. This finding is in opposition to that of Hinkel, Henrici and Haffner (quoted by Onodi), who reported normal fields in a large number of cases. Berger believes that peripheral field narrowing is most commonly observed, and Birch-Herschfeld lays stress on the presence of central scotoma when the optic nerve is affected in posterior sinusitis. From a perusal of the cases reported and those recorded here, it will be seen that my observations are in agreement with both of these authors.

The ocular symptoms occurring in nasal accessory sinus disease were fully discussed by the Laryngological Section of the British Medical Association at the Birmingham meeting this summer. Professor Onodi, in his very comprehensive paper, stated that field changes did occur, but not always. Dr. Adolph Bronner, in his reply, took exception to my statement that field changes were present in 90 per cent. of these cases, casting doubt on the correctness of my observations. He pointed out the necessity in making perimetric examinations, of using the same size test objects, of repeated observations, and the effects upon the fields of variations in illumination, the importance of excluding other causes, and the fact that disease was so frequently found present *post mortem*, when no trouble had been complained of in life. In making these observations I approached this subject from the ophthalmological point of view, and it will be seen from this and the previous paper that all the precautions suggested by Dr. Bronner, and more, were taken in the perimetric examinations. The exclusion of other ætiological factors is always a difficult

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matter; where such possibilities have been present they have been mentioned, but it has been obviously impossible for want of space to go into details of differential diagnosis in each case. A point that needs special emphasis is that a patient cannot be aware of a field defect unless it is a large central scotoma or a hemianopsia; but if the fields are examined in all cases of sinusitis, the above results will readily be found.

Two facts stand out clearly in this series of cases in the anterior group—peripheral contraction practically always occurs, and central scotoma not at all. These defects appear to present the same characters in antral and frontal sinusitis. The field limitations of the two eyes in bilateral sinusitis do not always correspond in form. White, red, and green are usually contracted, the colours generally more, and in particular the green Sometimes the field defects in one eye do not present the same characters, *e.g.* white altitudinal and green concentric in Case 19. The most commonly observed contraction in anterior sinusitis is concentric, but general contraction almost as frequently. In the latter, some portion of the field is more markedly affected, usually the temporal, but altitudinally not rarely. Temporal contraction in marked degree occurred in three cases, in which the anterior group was alone affected; however, as a rule it was but slight. In polysinusitis it is more marked when the sphenoid is one of the affected sinuses, thus bearing out my former contention that marked temporal contraction is a characteristic of the posterior group. Altitudinal limitation of the fields occurred in three cases of polysinusitis, in all of which the sphenoidal was affected, but not in antral or frontal sinusitis. Probably this form of contraction does occur more usually in the posterior group, and that my earlier hypothesis was incorrect.

The contraction occurring in the anterior group seems to be as marked as that in the posterior, excepting when acute ocular symptoms supervene. The degree of contraction is not necessarily any criterion of the severity of the sinusitis as gauged by the nasal symptoms—not infrequently a sinusitis causing no subjective symptoms is associated with marked defect. Reversal of the colour fields is generally held to be indicative of hysteria, but of the three patients showing this condition, two were very phlegmatic individuals. Normal fields were found in mucoceles and one antral sinusitis; the latter I shall refer to later. Central and ring scotoma have not been seen in this group.

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Ætiology of Field Affections.

The fact that field anomalies are present in 90 per cent. of sinusitis cases and normal fields in non-sinus affections of the nose (*vide* former article) is very suggestive that the sinus suppuration is the causal agent. This is also supported by the improvement which not infrequently takes place after successful sinus treatment, and the occurrence of unilateral defects on the same side as the sinusitis. Numerous reflex symptoms result from nasal irritation, and apparently this might be considered to be one of them; but this was discussed fully in my former paper. Pressure alone, particularly in the posterior group, has been suggested as the cause, but chronic suppurations are as a rule not "closed" sinuses, and therefore this is mechanically impossible. In one of the mucoceles very considerable proptosis occurred, but the fields were normal. Finally, papillœdema from pressure does not necessarily give rise to central scotoma (*vide* Case 2, article referred to), and therefore I think the chief cause is a local toxæmia.

The toxins in *chronic* cases would appear to permeate slowly through the thin sinus wall because the mucosa is usually atrophied, and offers less resistance to the passage of these substances. This hypothesis is supported by the presence of temporal contraction in the posterior group and a more general contraction in the anterior. In posterior sinusitis the nasal side of the optic nerve is in direct contact with the sinus wall, and consequently this part of the nerve is most affected, temporal contraction resulting. In the anterior group the toxin becomes diffused through the orbital tissues before reaching the nerve, which is not in contact with the sinus wall, hence the whole circumferential fibres are equally affected and general contraction follows. The mucosa in *acute* suppuration not being atrophied larger quantities are presumably carried by the vessels. Œdema of the nerve-sheath results when the posterior sinuses are involved, and central scotoma, peripheral contraction, and optic neuritis may follow from the pressure. But in the anterior group this cannot take place because of the loose orbital fat, so that peripheral contraction is alone seen. Optic neuritis and central scotoma are not observed unless there is some specially favourable factor (optic neuritis did occur in one polysinusitis, but the sphenoidal sinus was also affected). Central scotoma does not occur in chronic anterior sinusitis, because the macular bundle of the nerve is still almost central in position, and is protected by the circumferential fibres. In one chronic antral

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sinusitis, a young girl, the fields were normal. This was, I believe, because the antrum, being not fully excavated, had thick bony walls through which the toxins permeated less readily. Hysteria no doubt in some cases adds to the field contractions, but toxic substances are the chief cause.

Treatment and Prognosis.

In chronic suppurations efficient treatment of the sinus does not always improve the ocular symptoms, the nerve having been probably permanently damaged. Few cases, however, go on to optic atrophy, because the local toxæmia is mild in character. In acute suppurations rapid improvement takes place under treatment.

Conclusions.

Peripheral field contraction occurs in fully 90 per cent. of all sinus cases, and is usually caused by the action of toxins upon the nerve; the more common is concentric contraction. Central and ring scotoma do not ordinarily result in anterior sinusitis.

Treatment is most beneficial in acute suppurations. The perimeter should always be used in suspected sinusitis. Normal fields help to negative, and contracted fields to confirm the diagnosis. White and green are the best test-objects.

I wish to acknowledge my best thanks to Dr. Watson Williams, Mr. C. H. Walker, and Mr. Russ Wood, for permission to publish these cases.

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NINTH INTERNATIONAL OTOLOGICAL CONGRESS.

The Ninth International Otological Congress will be held at Boston, Mass., U.S.A., from August 12 to 17, 1912, in the new buildings of the Medical Department of Harvard University. Dr. John Clarence Blake, Professor of Otology in Harvard University, has been appointed President of the Committee of Organisation.

Intending members who desire to take part in discussions, in the reading of papers, in the loan of instruments or specimens, etc., are requested to send the title of their contribution, together with an abstract of the same, to the General Secretary, Henry O. Reik, 506, Cathedral Street, Baltimore, Maryland, U.S.A., as soon as possible.

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