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No. 1.

I.

A SYNDROME OF EAR AND SINUS SYMPTOMS
DEPENDENT UPON DISTURBED FUNCTION
OF THE TEMPOROMANDIBULAR JOINT.*

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The problem of temporomandibular joint function and occlusion being a major dental issue, it appears almost entirely in the dental literature. The following group of symptoms may be observed frequently in patients with endentulous mouths and a marked overbite; the syndrome is classic for lesions of the sinuses or ears; yet overbite and disturbance of the joint are so easily overlooked as etiologic factors that it becomes a source of error in analyzing cases in otolaryngology.

Conditions that have been given most attention in the medical literature are anterior dislocations, fracture of the neck of the mandible and ankylosis of the joint after chronic irritation or infection. These have received prolific comment, and appropriate surgical treatment has been carefully worked out.

Each of these symptoms may be ascribed to some evident disturbance in anatomic function of the joint, its ligaments and

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muscular attachments. The ear symptoms depend upon actual involvement of the eustachian tube and tympanic structures. The "sinus" symptoms are more apparent than real. The actual source of this group of complaints was confirmed by the marked improvement which followed correction of the overbite, renewal of molar support to take pressure off the condyle, and establishment of proper articulation of the condyle within the fossa.

The ear symptoms observed were:

Impaired hearing, continuously, or with intervals of improvement.

Stopping, or "stuffy" sensation in ears, marked about meal time.

Tinnitus, usually "low buzz" in type; less often, a snapping noise while chewing.

Pain, dull type, within and about ears.

Dizziness, mild; again, attacks of prostrating severity, definitely relieved by inflation of eustachian tubes.

Alleged "sinus" symptoms:

Headache, severe and constant, localized to vertex and occiput, and behind the ears—typical site of posterior sinus pain, but increasing toward the end of day (atypical sinus history, and suggestive of eye headache).

Burning sensation in throat, tongue and side of nose.

The diagnosis of this condition is established by:

1. The lack of molar teeth, or badly fitting dental plates, permitting overbite;
2. Mild catarrhal deafness, improved at once by inflation of eustachian tubes;
3. Dizzy spells, relieved by inflation of tubes;
4. Tenderness to palpation of mandibular joints;
5. Marked comfort to patient from interposing a flat object between the jaws.
6. Presence of the typical headache after sinus or eye involvement has been corrected; presence of the typical headache when sinuses or eyes are found to be negative.

Eleven cases in which disturbance of mandibular joint function was the chief etiologic factor of abnormal ear and head conditions:

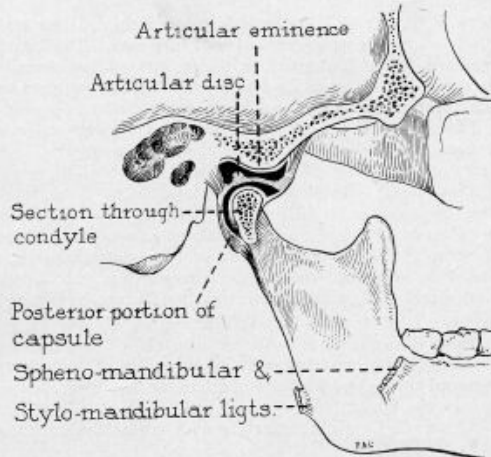


Fig. 1. The temporomandibular articulation. Schematic drawing to show position assumed by articular structures when full molar support is afforded (mesial aspect). No pressure is exerted on the meniscus by the condyle.

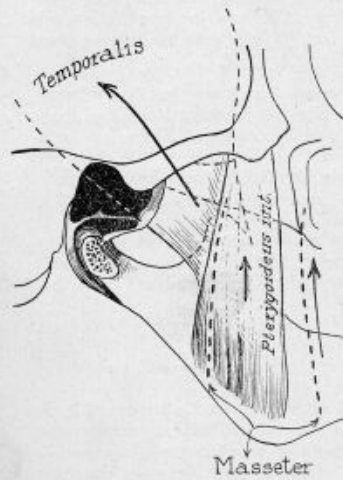


Fig. 2. Variety of movements increased in the pathological temporomandibular joint. With molar support gone, condyle is brought upward against meniscus, forward against articular eminence, or backward against tympanic plate.

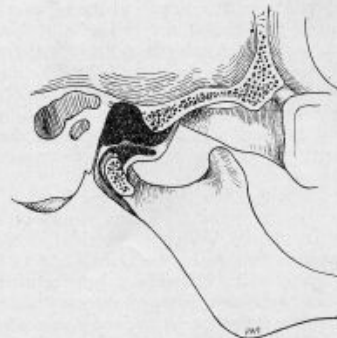


Fig. 3. Sketch of section through mandibular joint in a cadaver specimen. It demonstrated the effect of uncontrolled movement of the condyle in the edentulous mouth. The bone has undergone pressure (?) atrophy, excavating the glenoid cavity.

Case 1.—Mrs. P. F. N., 61. The past history of this patient was unimportant, the only events being concerned with the ears. The hearing was gradually impaired for a few years, with tinnitus of low buzzing type. The relatives noted her to be more deaf, or inattentive, at meal time; an hour later she seemed responsive and heard much better, denying stoutly any hearing difficulty. The object of examination was to prove whether or not she could hear, and consult a neurologist if necessary. No headache, or respiratory infection of importance. Occasional dizzy spell, attributed to "biliousness." Dental plates 20 years old.

Examination, September 27, 1927: The patient has a good structural nose with no evidence of chronic infection about sinuses or pharynx. Tonsils are small, atrophic. The ear drums are perfect, somewhat dull, slightly retracted. Inflation of eustachian tubes show the left patent, admitting air with normal sound. The right tube is tightly adherent, admitting no air.

Hearing distance is 30 feet on left, WV and CV. On the right, CV is heard at one foot, WV not at all. Weber to right. Diminished positive Rinne, both sides. Bone conduction slightly prolonged over examiners. C1 and C4 reduced on right. Marked overbite of the lower jaw, folding the lower lip over the upper.

Diagnosis: O. M. C. C., right; overbite with eustachian tube compression.

Proper dental plates were advised. No treatment of the ears was possible, as the patient lived in a small town at some distance.

On October 25, 1927, one month after opening of the bite with well-fitted plates, she returned for inspection. CV was increased from one foot to fifteen, and WV from 0 to ten feet. There were no further dizzy spells.

Case 2.—Mrs. A. K., 62. For many years this patient has had a "raw" feeling in the right side of the throat. She has frequent headache, daily, over the right eye, behind the right ear, and into occiput. There is a burning sensation, at the end of the day, in the right side of the nose and tongue, which extends at times to the right ear. No deafness or dizzy spells.

Examination, July 24, 1928: The nasal spaces are clear of infection. The lower turbinates are enlarged, but not occluding. In the nasopharynx, the right eustachian tube is set forward by a smooth mass, mucosa not broken on surface, and about 0.5 cm. in diameter. Palpation shows it soft in texture. The pharynx is otherwise normal. Upper and lower molars absent on right.

Hearing tests show normal hearing, bone conduction slightly prolonged. Biopsy of the mass was suggested and refused.

Diagnosis: Sphenoiditis, chronic, right; pharyngitis, chronic, secondary; nasopharyngeal tumor, right (?).

October 2, 1933. The patient returned after five years' absence. Biopsy was made and sections reported as chronic inflammation, lymphadenoid tissue. Palpation of the mass showed it still soft, not increased in size.

All molars, upper and lower, missing on the right. The right temporomandibular joint is quite tender to firm pressure, and bite closes with slipping of jaw to left, and wrenching of right joint. Observed through nasopharyngoscope, the soft mass in the nasopharynx is seen to bulge markedly on closure of bite.

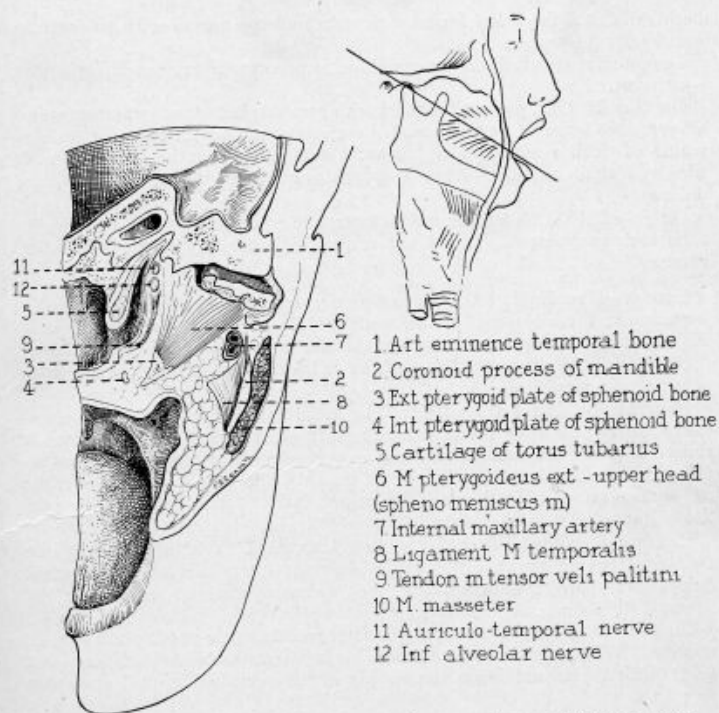


Fig. 4. This section was made in a cadaver specimen with mouth open, and the condyle well forward on the articular eminence of the temporal bone. In this position the sphenomeniscus muscle is taut. When the jaw is brought upward, as in a marked overbite, this muscle and associated structures are seen to relax, and the bulging tissues compress the membranous part of the eustachian tube.

The patient was sent to her dentist, and upper and lower denture fitted in the molar spaces on the right. The last report from her was three weeks after, and there was marked relief from the headache and burning sensation.

Case 3.—Mrs. W. H. B., 33. Patient is just beginning her allergic reaction to the fall grasses. In addition to the usual symptoms of sneezing, watery discharge, and obstruction of the nose, she has had a regular dull headache, localized about the ears and radiating to the cheek bones. The pain is daily and becomes severe by the end of the day. A burning sensation radiates to the right ear. Onset corresponds with extraction of lower molar teeth six months before.

Examination, July 30, 1932: Nasal spaces show allergic reaction, throat negative. Tonsils removed. Much dental work. Lower molars missing on

both sides, and the lower incisors close behind the uppers with an extreme overbite.

Diagnosis: Headache from mandible joint overaction; overbite of jaws—extreme.

On May 20, 1933, patient returned with previous headache symptoms more severe. No trace of her seasonal allergy may be seen in the nose. Complaints of "full feeling" in right ear; examination negative—tube normal. She was again urged to have proper fitting of jaw teeth, and this time did so.

On July 2, 1933, about one month later, she reported that all of her headache had disappeared. It did not return with her hay fever in the late summer.

Case 4.—Mrs. B. B., 63. For past two years there has been a noticeable impairment for whispered voice, with middle and low tones heard well. No tinnitus. No severe illness, or quinine medication. No headache or dizzy spells. All upper teeth have been extracted and an upper plate worn about nine years.

Examination, August 15, 1932: The nasal spaces are of fair structure, except for a low spur forward on the left. Ear drums perfect. Tonsils removed, small fragment in the left lower pole. The upper teeth are replaced by a plate, lower teeth in good repair. There is a forward overbite of almost one-half inch, and the upper incisor teeth edges cover the lower gums.

Hearing distance, CV is thirty feet, both ears. WV is heard at one foot on left, not at all on right. Weber not lateralized. Rinne normal. Schwabach, bone conduction time approximates that of examiners for normal, 40 seconds.

On June 19, 1933, patient reported, after wearing new upper plate for six months. Whispered voice increased to five feet, both ears. There was great difficulty in making a proper plate, and occlusion is still obviously very bad.

Case 5.—Mrs. J. S. M., 55. This remarkable case has been an invalid with paralysis agitans symptoms for four years. The tremor was confined to the hands, weakness and gait difficulty prevented any effort at walking, and attacks of mild dizziness made the patient refuse to sit up in bed. The hearing was impaired, with sensation of "stopped ears." There was a dull temporal and occipital headache, daily. The presence of occasional infection about the posterior sinuses seemed to prove this the source of the headache, and in view of the tendency to become worse, a resection of the posterior sinuses was considered. The gravity of this procedure brought in consulting advice.

Examination, November 15, 1932: The nasal spaces were entirely normal except for some hyperplasia about the posterior sinuses. The pharynx was negative. Ear drums perfect, slightly dull and retracted. Very flat, and poorly fitting plates, 22 years old, permitted an extensive overbite of the jaw. Palpation of the mandibular joint showed marked tenderness, both sides.

Hearing distance for spoken voice was thirty feet, both ears, whispered voice not heard. C4 and C gross forks not heard, middle C heard well. Weber not lateralized. Bone conduction prolonged to sixty seconds. Rinne

September 3, 1933. On this date she fell, breaking several ribs.

The hearing is improved and the dizziness disappears as long as she can report weekly for inflation of the eustachian tubes. After explaining the condition to her, she has had marked relief, also, from holding a small pad of gauze between the jaw teeth.

Case 7.—Mrs. S. L., 55. This patient was admitted on the neurological service at Barnes Hospital on April 18, 1933. Routine examination was entirely negative. She had a history of headache, covering a period of ten years. The pain was dull, distributed over eyes, in the parietal region, and around the ears. It had become more severe the past winter. No hearing impairment or ear symptoms. She was referred for sinus study.

Examination, April 19, 1933: The sinus groups were negative except for a small amount of mucopus in the middle meati. Throat negative, ears normal. X-ray study showed maxillary involvement on both sides, and clouding of the left frontal.

The 18-year-old dental plates showed a wide overbite, with a ludicrous weaving of the lower jaw during attempted occlusion. Tenderness may be elicited on palpation of each mandibular joint.

She was advised to have the mouth refitted with proper dentures, before attempt to correct the rather inactive sinus condition. This was promptly done. She reported by letter after four months, that all of her headache symptoms had entirely gone.

Case 8.—Mrs. O. J. K., 64: For several years this patient has had a pain or ache which is occipital, worse on the right side, and during the daily attack has a low buzz in the ears. No history of nasal infection. Family notice hearing impairment, but she is not aware of it.

Examination, April 30, 1933: Shows good structural nose, no trace of infection observed. The pharynx is normal, tonsils small. Ear drums are dull, slightly retracted. The lower plate, which is ill fitting (10 years old), allows a marked overbite. Two tongue depressors held flat between the jaw teeth is a noticeable comfort to the patient. (The patient then remarked that holding the mouth open at night always prevented headache. She reasoned that this kept the "cold air" out of her nose and helped the headache.)

Fork tests were within normal range, except for hearing C4 and C gross poorly. Hearing distance normal for CV, reduced to 10 feet for WV.

Diagnosis: O. M. C. C., mild; overbite with pathological joints.

On May 13, 1933, patient reports wearing a new lower plate one week, with complete relief of her symptoms, and improvement in hearing.

On August 1, 1933, a further report from the patient, that she has had no further symptoms, and hearing is improved.

Case 9.—Mr. J. W. T., 47. The patient complains of recurrent attacks of "stiffness" in ears for several years, with muffling of sounds. He has been treated by an otologist for one year with transient improvement. During the year he had a nasal operation—resection of right sphenoid. He still has an occasional occipital headache. The hearing involvement corresponds roughly with the extraction of all his molar teeth for arthritis five years ago.

Examination, June 2, 1933: The ear drums are normal except for slight retraction. Nasal spaces show sphenoid resection, right side, thin mucopus pouring from all posterior sinus groups. Pharynx is negative. There is

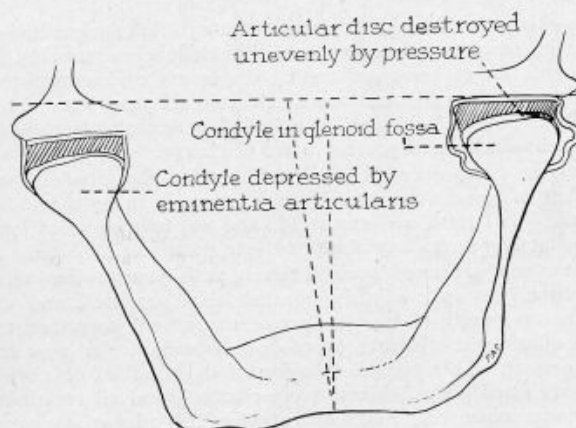


Fig. 6. Asymmetric position of condyles due to uneven support of molars or lack of support on one side. (Prentiss.)

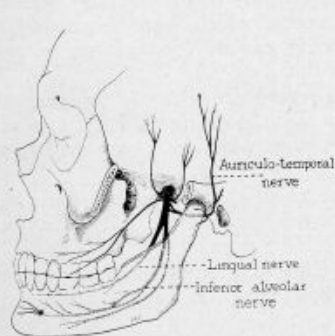


Fig. 7. Sketch showing the distribution of the mandibular nerve and the course of the auriculo-temporal nerve. (Henle.)

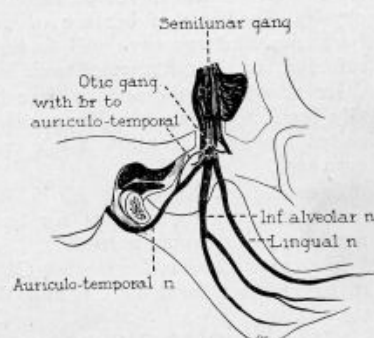


Fig. 8. Diagram of mesial view of mandibular nerve showing auriculo-temporal nerve and its connections with the otic ganglion. (After Spalteholz.)

marked malocclusion of the remaining teeth, and, with all molars extracted, the lower incisors rest on the hard palate, one-half inch behind the upper.

Fork tests within normal limits. Hearing distance reduced for WV to ten feet on right, and for SV to six feet. Both are normal at thirty feet on left. The distance is improved by inflation of the right tube to fifteen feet, both SV and WV.

On October 5, 1933, after wearing inlays of molar teeth three months, hearing tests show the same improvement as obtained on the first inflation. He has had no further "stuffy" sensation in ears, and no further headache. The dentist has had extreme difficulty because of his badly deformed jaw.

Case 10.—Mrs. C. F. G., 55. Fifteen years ago this patient had a severe influenza, with nasal trouble ever since. She definitely associated the nasal infections with loss of her upper teeth. Any severe cold seemed to localize in one sinus or other. All teeth were extracted six years ago. This attack dates from a severe cold one month before examination, with daily supraorbital headache, and profuse nasal discharge.

Examination, September 19, 1933: Generally the nose is somewhat crowded, but of good structure. Heavy mucopus in both middle meati. Ears normal. All teeth are extracted, and on first examination it was not noted that there was any abnormal jaw position.

The antra were irrigated several times, with prompt improvement in nasal infection. In spite of this, her headache persisted, and when she returned in one month X-ray study was made, and operative treatment of sinuses considered. Before proceeding, however, she was sent to a prosthetic dentist, who reported retrusion of the condyles on chewing, due to improperly fitted plates. These were changed, and all remaining headache symptoms improved. Sinus operation is still advised, in view of her serious handicap of chronic sinus infection.

Case 11.—Mr. E. A. F., 73. This patient has a remarkably negative past history, and is still in perfect health. He recently had a thorough routine physical examination because of dizzy spells, which were increasing in frequency and severity. All findings being essentially negative, he was referred for the question of toxic labyrinthitis.

He stated that the attacks were brief, severe enough only to occasionally reach for support. There has been some stopping of ears, and impaired hearing. Tinnitus, a low crackle, only when he yawns widely to open ears.

Examination, November 15, 1933: The nasal spaces are free of infection, structures good except for broad septal spur on the left. Pharynx negative. Ear drums normal.

Fork tests show reduction for C4 and C gross, hearing distance reduced to twenty feet for both CV and WV, both ears. No spontaneous nystagmus.

Diagnosis: O. M. C. C., bilateral, mild.

There is a marked overbite of his badly fitting plates, the jaw instantly feeling more comfortable when resting the molar teeth on three tongue depressors, equal to about one cm. in thickness.

Inflation of the eustachian tubes entirely relieved the dizzy attacks and he proceeded to replace the old plates. All his symptoms are improved with the new jaw position effective a few days.

Wright¹ and later Decker² reported cases demonstrating compression of the cartilaginous canal by habitual retrusion of the condyles of the mandible. These authors ascribe deafness in those individuals to: (1) Compression of external canals to point of closure, (2) trauma to tympanic structures and irritation from the continued click and pound as the condyles slip backward with each closure of the mouth.

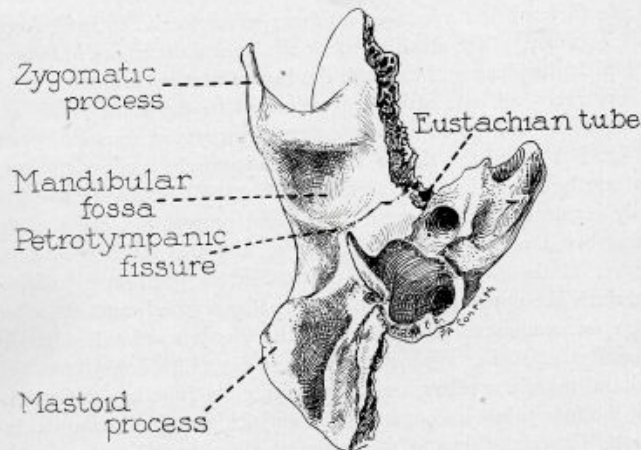


Fig. 9. Lower aspect of temporal bone, showing the petrotympanic fissure quite high, within the depression of the mandibular fossa. In such relation as this, the chorda tympani nerve emerging at the mesial end of the petrotympanic fissure, is subject to irritation from the movements of the condyle in a pathological mandibular joint. (Drawn from a specimen in the anatomical collection of Dr. R. J. Terry, Washington University School of Medicine.)

If these deductions are accepted, it would be on the basis of some type of concussion of labyrinthine structure or injury to the eighth nerve, in which case the recovery of hearing after correcting the joint function would be very slow. Their cases, as well as most of the present series, promptly improved in hearing within a few days or weeks after restoration of proper occlusion. The temporary nature of such deafness seems clear. The symptoms of dizziness in cases 1, 5, 6, 8 and 11 temporarily disappeared with the first inflation of the eustachian tubes and hearing distance was improved during the test. The rôle of compression of the eustachian tubes and a resultant conduction deafness was quite evident; and the association of dizziness with improper regulation of the intratympanic pressure was repeatedly demonstrated. Cases 5, 6 and 11 habitually practiced opening the mouth as in a yawn to relieve dizziness and coincident "stopped" feeling in the ears.

Looking to anatomic reasons for such a pressure effect, we find a definite basis for compression of the tubes. A section (Fig. 4)

made through the articular eminence close to the glenoid fossa, passes through the attachment of the sphenomeniscus muscle to the articular disc, and through the lumen of the eustachian tube; it embraces all soft structures adjacent to the tube. With the joint in normal position, the external pterygoid muscle is taut (Fig. 5-A), and the tensor veli palatini muscle borders the tube anteriorly on an almost straight line (Fig. 4-9). Between these lie only connective and adipose tissue, and posteriorly, close to the tube, are the auriculotemporal nerve and the inferior alveolar nerve. If the jaw is brought upward into a position of marked overbite, the upper head of the external pterygoid muscle (called the sphenomeniscus muscle by Prentiss⁴) is relaxed and a bundle of soft tissue piles against the tube. (Fig. 4.) The tensor veli palatini muscle appears loose, preventing its function in tightening the soft palate and opening the eustachian tube during deglutition. Especially during the act of swallowing, when the tensor palatini muscle usually opens the eustachian tubes, the compressing effect of the tissues on the tube from the overbite is present and prevents it.

The very looseness of the capsule of the mandibular joint and its restraining ligaments now works to further exaggerate the pushing of tissues toward the tube. (Figs. 5-B.) With each overacting closure of the mandible by the masseters the internal pterygoid and temporal muscles, the condyle is shoved upward against or through the atrophic or perforated meniscus, or it moves backward to the tympanic plate and pushes mesially on one side or the other through the loose capsule. This happens countless times with each meal, when the patient retrudes the jaw to occlude his poorly fitting plates.

Prentiss⁵ observed with wide variations of thinning of the meniscus that perforations were produced on various areas. Its location would depend upon the angle at which the condyle was forced against the meniscus; such an uneven pressure follows the unilateral loss of molar support. (Fig. 6.)

The overbite with atrophy of the joint structure occurs at once if the dental plates are poorly fitted and allow it. It develops slowly if the same plates are worn for many years, and shrinkage of the bone in the dental ridges is marked.

Goodfriend⁵ recently gave exhaustive reports on the symptomatology and treatment of abnormalities of mandibular articulation, with emphasis on the mechanics of repositioning the mandible and establishing the proper dental occlusion. His analysis of ninety-one cases shows only 12 per cent of the group are aware of the joint symptoms and that the majority of them seek treatment for the associated reflex symptoms. Deafness leads the list of primary complaints, and then come, in order of frequency, bite anomalies, speech defects, snapping of joints, tinnitus and eczema of ear canals, facial deformities, pyorrhea, malocclusions, and lastly, vertigo. Audiometric examinations were made in an otolaryngologic clinic and these showed 13.3 per cent loss of hearing for the abnormal group, but the type of deafness was not reported.

This important investigation demonstrates the following points:

(a) That the patient mentions deafness most frequently as a primary complaint, vertigo last, and headache not at all. (This means that the patient does not associate the two symptoms, and that the vertigo is mild and recurrent over a long onset period. In my group, cases 6 and 11 were referred by internists suspecting toxic labyrinthitis.)

(b) That treatment is sought by the majority of patients for headache and referred pains, the result rather than the unsuspected mandibular joint disease.

The anatomic explanation of pain in connection with disturbed joint function is fairly simple, if recognized: (1) deep erosion of the bone (Fig. 3) of the glenoid cavity leaves only a thin plate between the condyles and the dura—practically nil (Prentiss⁹). Each closure of the jaw impacts this evacuated area with the condyle, which thus rocks in the glenoid fossa, barely separated by the remaining thin bone from the dura and its rich nerve supply. (2) With some of the chewing movements and closures of the jaw, the condyle exerts pressure on or near the auriculotemporal nerve which passes intimate to the mesial side of the capsule and between the condyle and the tympanic plate to distribute over the temporal region. (Fig. 7.) (3) Further, in the type of pathologic joint in which the condyle snaps backward over the articular disc, impacting and eroding the tympanic plate, the chorda tym-

pani nerve passes this spot through the iter chordæ anterior at the medial end of the Glasserian (petrotympanic) fissure. (Fig. 9.) It is therefore quite evident that dull vertex pain from this source may be of dural origin, that pain over the temporal region originates in irritation of the auriculotemporal nerve, and that the pains referred to the side of the tongue may be attributed to pressure on the chorda tympani nerve.

SUMMARY.

Headache and ear symptoms directly dependent upon disturbed function of the mandibular joint frequently occur in cases showing sufficient pathology about the sinuses to otherwise account for them. There are so many medical, rhinologic and ophthalmologic reasons for headache distributed about the ears, vertex and occiput; and there are so many nasal changes to account for eustachian tube obstruction, that evulsion of the condyle of the mandible from overbite is not considered.

Hearing tests show a mild type of catarrhal otitis with eustachian tube involvement, usually simple obstruction. This is due to pressure on its anterior membranous wall, transmitted through soft tissue from the relaxation of pterygoid muscles and associated sphenomandibular ligaments during overbite.

The promptness with which the ears improve seems to controvert the idea that the ear condition is due to trauma or concussion of the labyrinth or tympanic structures from the condyle of the mandible. Cases of shock to the labyrinth from a blow on the chin are not within the scope of this paper.

Attacks of dizziness in these cases are obviously due to changes in intratympanic pressure affecting the labyrinth. The effect is transient and recurrent, relieved by inflation of the eustachian tube, and not the picture seen in toxic labyrinthitis.

The areas involved in the headache cases are typical of headache of posterior sinus origin and are easily taken for such. Persistence of the headache after indicated sinus surgery is sometimes due to mandibular joint pathology.

The symptoms arise as a result of overaction of the joint at first, and later adds the regional effect of a loose, pathologic joint,

produced by absorption of the meniscus, condyles and surrounding bone.

The prognosis in a given case depends on these factors: (a) the accuracy with which refitted dentures relieve abnormal pressure on the joint; (b) the extent of injury to the tube and to the condyle, the meniscus, and the joint capsule.

The mechanics of occlusion and dental problems are not included here. Only sufficient reference to the anatomy of the mandible and joint is made to clarify the ear or sinus diagnosis.

Anatomic reasons are advanced to account for abnormal conditions of the eustachian tube, and for the distribution of pain toward the vertex, occiput, pharynx and tongue. It is barely possible that mandibular joint pathology may be an etiologic factor in glossopharyngeal neuralgia, the association of chorda tympani and auriculotemporal nerves with the ninth occurring via sensory connections to the otic ganglion.

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