

MORTON (T.S.K.)

INDEX

MEDICUS

METATARSALGIA

(MORTON'S PAINFUL AFFECTION
OF THE FOOT):

ITS CAUSES, SYMPTOMS, AND TREATMENT; WITH
ILLUSTRATIVE CASES AND BIBLIOGRAPHY.

BY

THOMAS S. K. MORTON, M.D.,

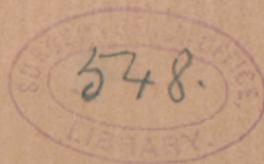
PROFESSOR OF SURGERY IN THE PHILADELPHIA POLYCLINIC; CONSULTING SURGEON PHILADELPHIA
DISPENSARY; CONSULTING SURGEON DOUGLASS HOSPITAL; SURGEON POLYCLINIC HOSPITAL;
OUT-PATIENT SURGEON PENNSYLVANIA HOSPITAL; ASSISTANT SURGEON PHILADEL-
PHIA ORTHOPEDIC HOSPITAL AND INFIRMARY FOR NERVOUS DISEASES.

Reprinted from the Transactions of the Philadelphia Academy of
Surgery. Meeting of March 6, 1893.

SECOND EDITION, REVISED AND ENLARGED.

PHILADELPHIA:

1895.



N O T E.

Although a large number of copies of the original reprint of this brochure was at my disposal, yet the last one has been called for and sent away, while requests from almost every part of the country for it or literature of the subject continue to reach me in increasing frequency. Hence I have determined to print this second edition of the pamphlet for those who may desire it, and at the same time take advantage of the opportunity afforded to record some additional observations and experiences and to bring the bibliography up to the present time.

T. S. K. M.

December, 1895.

METATARSALGIA.

THE affection that has come to be best known as "Morton's Painful Affection of the Foot," or "Morton's Toe," was first described and a method of certain cure presented by Dr. Thomas G. Morton, of Philadelphia, in 1876, under title of "A Peculiar Painful Affection of the Fourth Metatarso-phalangeal Articulation."* In subsequent publications † he has confirmed his views relative to cause and treatment, and reported large numbers of cases.

The disease under consideration may be described as a painful affection of the plantar digital nerves, directly caused by pressure upon or pinching of them or of their articular branches by certain portions of the metatarso-phalangeal articulations—especially the fourth.

The reason for the fourth toe being the almost invariable seat of origin of the train of painful and neurotic symptoms to be discussed is ascribed to anatomical causes by Morton in the following language:

"The occurrence of neuralgia may be understood by a reference to the anatomy of the parts. The metatarso-phalangeal joints of the first, second, and third toes are found on almost a direct line with each other, while the head of the

* American Journal Medical Sciences, January, 1876.

† Surgery in the Pennsylvania Hospital, 1880, p. 107; Philadelphia Medical Times, October 2, 1886.



fourth metatarsal is from one-eighth to one-fourth of an inch behind the head of the third, and the head of the fifth is from three-eighths to half an inch behind the head of the fourth; the joint of the third, therefore, is slightly in advance of the joint of the fourth and the joint of the fifth is considerably behind the joint of the fourth.

FIG. 1.

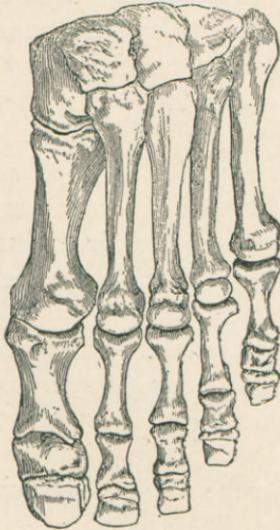
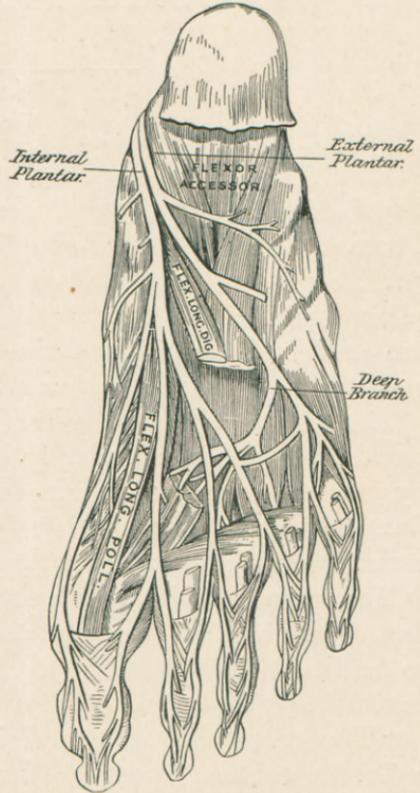


FIG. 2. (Gray's Anatomy.)



“The fifth metatarsal joint is so much posterior to the fourth that the base of the first phalanx of the little toe is brought on a line with the head and neck of the fourth metatarsal, the head of the fifth metatarsal being apposed to the neck of the fourth. (See Fig. 1.)

“On account of the character of the peculiar tarsal articulation, there is very slight lateral motion in the first three metatarsal bones. The fourth has greater mobility, the fifth still more than the fourth, and in this respect it resembles the fifth metacarpal. Lateral pressure brings the head of the fifth metatarsal and the phalanx of the little toe into direct contact with the head and neck of the fourth metatarsal, and to some extent the extremity of the fifth metatarsal rolls above and under the fourth metatarsal.

“The mechanism of the affection now becomes apparent when we consider the nerve-supply of the parts. The branches of the external plantar nerve are fully distributed to the little toe and to the outer side of the fourth; there are also numerous branches of this nerve deeply lodged in between these toes, and they are liable not only to be unduly compressed, but pinched by a sudden twist of the anterior part of the foot. (See Fig. 2.) Any foot-movement which may suddenly displace the toes, when confined in a shoe, may induce an attack of this neuralgia. In some cases no abnormality or other specific cause for the disease has been detected.”

This explanation undoubtedly will account for the great majority of cases, and perhaps all could be ascribed to pinching of the nerves between the metatarso-phalangeal articulations. Yet there have been reported a few cases where the transverse metatarsal ligament has appeared to be lax or ruptured, thus permitting the metatarsal heads to descend upon the nerves. Dr. Auguste Poullosson, of Lyons, France, in 1889,* after reporting a typical case, says that “the cause of the affection is evidently a certain laxity of the transverse metatarsal ligament, which permits partial infraction of the arch formed by the heads of the five metatarsal bones, one of

* Lancet, March 2, 1889, p. 346.

the middle ones, probably the third, becoming dislocated downward and compressing the nerves running along each side of it against the heads of the neighboring bones."

Mr. L. G. Guthrie,* in writing of metatarsal neuralgia, states his belief that "under the influence of prolonged standing or walking in tight boots, the ligaments of one or more joints, metatarso-phalangeal or phalangeal only, become strained, slight subluxation takes place, the nerves are stretched and pressed upon by the partially dislocated bones, and the characteristic pain is produced."

Dr. Charles E. Woodruff,† of the United States Army, believes that there are several painful affections of the metatarso-phalangeal articulations due to incomplete luxations of the bones. He testifies, as a subject himself of the disease, that these luxations, though seemingly trivial, cause such distress and inconvenience, and at times the pain becomes so severe as to be almost unbearable. He refers to a variety of the disorder (including that of his own foot) which he considers different from the ordinary form, occurring in people not accustomed to much standing or walking, not having relaxed ligaments nor flattened metatarsal arches, and having no history of injuries. "They are all due to a very slight displacement upward of the proximal end of the first phalanx of the third or fourth toe, generally the third, and caused by forced dorsal extension of the toes on the metatarsus. In some cases the luxation is brought on by merely assuming a partially kneeling attitude, with the sole of one foot upon the floor, and the other supported on the extended toes, the person almost sitting on the latter foot, thereby resting

* "On a Form of Painful Toe." *Lancet*, 1892, vol. i. p. 628.

† "Incomplete Luxations of the Metatarso-phalangeal Articulations." *Medical Record*, January 18, 1890.

his whole weight on the extended toes. Habit undoubtedly is a great factor in perpetuating the trouble, and after a few attacks the dislocation is produced by very trifling motions of the toes.

“It is this very slight degree of luxation which I have often made out in my own case, and which is the cause of all the agonizing pain which soon appears. The pain is of a burning character, and located in and under the joint. Should the luxation remain unreduced, the burning becomes steadily more and more severe, and finally involves the whole anterior part of the foot. Yet the pain will cease as if by magic when the luxation is reduced.

“Extension and counter-extension applied with force enough to produce the familiar ‘snap,’ or ‘crack,’ will invariably, in my own case, reduce the luxation and stop the pain; and in the other cases in which I have advised it, the shoe can be worn at once and with comfort.”

In reference to the supposed dislocations above mentioned, Morton says :

“The dislocation referred to is not a true dislocation, but is simply a twist of the toe, and a violent spasmodic condition of the muscles of the toe incident to the intense pain, simulating a dislocation, which, when the toe is compressed laterally, and in its rolling between the third and fifth suddenly, presses upon and pinches the underlying plantar-nerve branch.”

Dr. Edward F. Grün,* himself a sufferer from the affection, believes that the pain results from descent of the tarsal arch, which is accompanied by lengthening of the foot and spreading to the outer side, so that “where the weight comes on the member the foot spreads inordinately; the boot is not

* London Lancet, April 6, 1889, p. 707.

constructed to allow for so much spreading, and a frightful cramping pain is the result, causing the patient to remove the boot without regard to place or circumstances—often the most inconvenient.”

Dr. Joel E. Goldthwaite, of Boston,* believes that metatarsalgia is induced by a breaking down of the arch which he claims to have proved to exist across the foot at the level of the metatarsal heads. This he proposes to call the “anterior transverse” arch of the foot, and has elaborately studied it by means of frozen sections and extensive clinical observation, including numerous foot impressions. He states that this “anterior transverse arch is formed by the heads of the metatarsal bones; the first and the fourth and fifth (which act together) furnishing the base, while the second and third are raised above this plane, forming, as seen on cross-section, a low arch. This relation is maintained by the transverse ligament, the transversalis pedis muscle, and the tendons of the peroneus longus and the tibialis posticus muscles. The plantar fascia, which is reinforced in its anterior expansion by transverse fibres, and the tendon of the flexor longus digitorum muscle—from its insertion and its oblique course across the sole of the foot—undoubtedly also exert some influence.”

“It is evident from a study of a large number of impressions of the feet that the obliteration of this transverse arch is very common—much more common than the flattening of the longitudinal arch—and that comparatively few persons suffer any inconvenience from it. In a limited number of cases, however, this condition, usually so simple and of so

* “The Anterior Transverse Arch of the Foot; Its Obliteration as a Cause of Metatarsalgia.” Boston Medical and Surgical Journal, September 6, 1894, p. 233.

little importance, becomes more serious, and symptoms develop which at times are most distressing and render treatment necessary."

Dr. V. P. Gibney * quotes approvingly Morton's explanation of the malady as well as the treatment outlined. He is convinced that three factors enter into metatarsalgia: 1, the twist or injury; 2, a moderate grade of flat foot; and 3, the rheumatic or gouty diathesis. He recommends, and has found very satisfactory, the wearing of a Spanish last shoe for the minor grades of the neuralgia. This was suggested to him by an orthopedic shoemaker with the object of raising the arch of the foot and making considerable pressure across the instep. He found, after a little experimenting, that a boot built on such a last and laced snugly across the instep, and left rather free across the ball of the foot, with a modified French heel, that is, a combination of a French heel and English heel, would nearly always give some relief. The Spanish last is nothing more than a last with a high instep. The rather long heel throws the weight well forward upon the centre of the boot.

Dr. E. H. Bradford † states that the results of treatment in these cases, as well as the symptoms and localization of the point of severest pain, make him agree with Morton, in believing the affection to be originated by pinching of the metatarsal nerve, rather than to flattening of the tarsal arch, as suggested by Poullosson. In none of his thirteen cases was any degree of flat-foot present.

In a large number of cases seen by me, in addition to those herein reported, it has not been possible to demonstrate any

* Journal Nervous and Mental Diseases, 1894, p. 589.

† "Metatarsal Neuralgia, or Morton's Affection of the Foot." Boston Medical and Surgical Journal, 1891, vol. ii. p. 52.

laxity of the metatarsal ligaments, and, while in a few the pain was referred to other of the metatarso-phalangeal joints than the fourth, yet upon careful manipulation it was always found that the pain was reflected from the fourth to the other joints. It must be conceded, of course, that laxity or rupture of the transverse ligament would predispose to injury of the nerves at the fourth joint by permitting greater motion of the overlapping bony points in that situation. However, while the exact etiology of the affection is of great scientific interest, clinically it is of small account, as excision of the fourth metatarso-phalangeal articulation, as originally proposed by Morton, or amputation of the fourth toe, including the corresponding metatarsal head, invariably has secured an absolute and permanent cure. No dissections of the diseased regions have yet been possible, but in a few instances where the nerves have been excised a condition of swelling and inflammation, neuritis, has been proved. I have carefully examined a number of the joints that have been removed for the cure of the affection, and have in no instance been able to prove any anomaly or alteration in them.

Metatarsalgia is, in its lesser degrees, a very common disease. Almost every one has suffered more or less, at times, from neuralgic twinges radiating from the joint in question. These mild cases occasionally develop into the more severe forms. In them occasional attacks of pain are often followed by periods of complete immunity.

Morton made extended inquiries among retail shoe dealers and found "that this peculiar condition had not only been frequently recognized by them, but that it is also considered to be quite common. Almost every intelligent shoe retailer has seen a number of persons to whom this disease has been a source of frequent suffering, and who believe their malady to be beyond relief by medical art; indeed, it would seem

that in some of the most severe of the cases it has been found impossible to obtain the serious consideration of their condition by their medical attendants."

So recently as 1891, Bradford* has written:

"It is somewhat singular that an affection that is not infrequent in these days of thorough investigation of all ailments, should have attracted but little attention, either in the researches of surgeons or of neurologists. The cases are so usually classed among the ill-defined hysterical or nervous affections, and not thoroughly investigated; or they are deemed to be gouty, as, in the minds of many practitioners, are frequently all affections of the toes."

Dr. J. F. Bosc, of Montpellier, France in a very elaborate essay upon metatarsalgia ("La Maladie de Morton; Névralgie Métatarsienne Antérieure") in the *Archives Générales de Médecine* for July and August, 1894, states that the disease appears to be only generally known in America and England, but that he is convinced that it is quite prevalent in France, and reports a number of typical cases to bear out his assertion.

Dr. C. Devrient, in the *St. Petersburger Medicinische Wochenschrift*, January 12, 1895, reviews the subject of metatarsalgia, reports a case, and proposes as the most accurate name for the disease "Morton's Neuralgia nervi plantaris externi im Metatarsophalangealgelink IV."

The disease has not been observed before adolescence. Women are certainly more predisposed than are men, and its occurrence in the former sex I should judge to be almost twice as frequent as in the latter. One foot is most usually involved, especially in those cases apparently taking origin from an injury. But very frequently one foot is affected to

* Loc. cit.

an almost unbearable degree, while its fellow is only slightly involved. Neither right nor left foot appears to be most liable to involvement unless one or the other is constantly subjected to a motion, as in running certain sewing-machines, looms, lathes, etc., while the other is not employed. In this case, as in one of my own, the pain usually develops in the foot so employed. When both feet become simultaneously affected, the cause will often be found in ill-fitting or tight shoes. Middle life is the period at which the disease is most apt to develop or to become severe. The aged are by no means exempt, although in them more purely gouty or neuralgic forms are prone to occur, and persons at any age so predisposed appear to be much more liable to the affection—idiopathic or traumatic—than are others.

The influence of heredity is very marked. I know of several families in which a number of persons, mainly confined to the female sex, are similarly affected. It is interesting to note that in these instances some cases have arisen from twists or sprains of the foot, and others apparently idiopathically.

The exciting or immediate cause of metatarsalgia is usually excessive or unusual exercise of the feet while confined in new, tight, or ill-fitting shoes, as in walking over rough surfaces (mountain-climbing), dancing, playing lawn-tennis, etc., or in changing from a firm-soled shoe to one that permits great motion of the metatarsal arch. When the heads of the metatarsal bones are rigidly held in contact by a tight shoe, it is reasonable to believe that a very slight twist or wrench of the foot would bring great pressure to bear upon the sensitive branches of the digital nerves distributed upon and about them, and particularly in those predisposed thereto, bring about a neuralgic and even neuritic condition. This once set up, and the nerves having

become sensitive, swollen, or inflamed, ever so slight repetitions of the pressure or bruising are capable of originating the most agonizing suffering. Later, continuous or frequently recurring attacks of this pain, or actual ascent of neuritis, commence reflex contractions and other neurotic complications, perhaps of the gravest type; as witness in Case I. of my series, where the patient had become bed-ridden and severely neurasthenic, as well as the extraordinary instance reported by Dr. Osborne (p. 27).

So far as relates to symptomatology, I shall depend upon quoting a few more or less typical cases from the literature of the subject and upon the histories of some of my own operative cases, but may here mention that I regard the imperative necessity of removing the shoe, regardless of surroundings, when a paroxysm comes on, as a pathognomonic symptom of the disease. It may also be said that no evidence of the disease can usually be felt or seen, except that the parts are often of a bluish tint and cold, from venous stasis, and have a tendency to profuse perspiration.

CASE I.—Miss I. F. S., aged thirty-one years, teacher, was brought to me by her physician, Dr. George L. Romine, of Lambertville, New Jersey, in June, 1892.

The following history was elicited: Family history excellent; she had always enjoyed the best of health and strength until the present trouble commenced. In July, 1890, she played lawn-tennis for the greater portion of a day, coming down heavily on the balls of the feet many times, after which she walked a short distance to her home, and felt greatly fatigued. After resting two hours she attempted to walk, and experienced a "queer sensation" along the outside of the left foot, a feeling "as if something had given way about half-way between the toes and heel."

"In the evening I walked down town, but could scarcely

return, for it was so hard to make my foot go. I felt as if retarded in some mysterious way. By the time I reached home a line of pain extended from the place above mentioned all the way to my hip. Thinking I had sprained my foot, I applied the usual remedies. The next morning my foot felt rested, but during a short walk on the street the pain in my foot and limb returned.

“By this time the foot began to swell, particularly along the outside, and in a few days had a reddish appearance. After a night’s rest the swelling disappeared, and I was able to use my foot, with intervals of rest, in ordinary walking about the house. Each day it gave out after less use, so at the end of five days I called in our family physician, Dr. Romine, of Lambertville.”

It was presumed that a ligament or tendon had been ruptured, and fixation by bandages resorted to. On August 7 these dressings were removed.

“The foot and limb were helpless, and the whole side of the foot felt so indescribably bad that it made me faint. A starched dressing was then put on the foot and limb to the knee. For four or five days following I held my foot on a chair, but after that, during part of the day, on a pillow on the floor. Toward evening I had almost unbearable tingling in the foot, but this passed away on retiring. I never could rest my foot on the outside from the time of the accident without having that unbearable feeling in the foot, and at times the line of pain in the limb.

“At the end of four weeks the doctor told me to stand with my feet even. Never shall I forget what I suffered that day. The limb had shortened so that the heel was about two inches from the floor, and in trying to stretch it down the bottom of the foot pained and tingled dreadfully. I was completely exhausted and deathly sick.

“Crutches were then ordered, and I commenced my hard work of learning to walk.

“My foot was so bad on the side, and a line of dreadful pain extended from about two inches from the fourth toe along the side of the foot and to the knee. After a time the pain in the limb seemed better, but the whole side of the foot felt unspeakably bad. The uncomfortable sensation did not seem confined to any particular place on the side, as it did at first.

“The first of October the physician advised my going to school in order to overcome my nervousness, and take my mind from the foot. I wore a worsted slipper.

“The last of October the doctor commenced the use of a battery every night,—the interrupted current being used. The sponge was applied under and over the toes five minutes, five on each side of the heel, and five under the knee. The toes twitched a great deal, and I always dreaded when the sponge neared the fourth and fifth toes, for I felt the sting and jerk along the injured side, and it made me sick. I could bear only a light pressure there. When applied under the knee I felt the line of pain down the outside of the limb, and often the toes would jump. When the current passed down the inside of the limb it felt agreeable.

“My foot always felt badly on removing the shoe at night, and the limb above was very much swollen and glossy in appearance.

“The last of July, 1891, I took a short walk, without support, along the piazza. That night my foot pained up to the knee, and I was unable to touch it to the floor for more than a week. I was careful to take only a few steps at a time after that. At the end of a year this was all I could do.

“If I rubbed the foot, or put it down otherwise than just flat when I stepped, I was unable to use it afterward.

“I used crutches all the time at school, so as not to over-tire my foot again; but, in spite of all my care, I had that dreadful feeling on the side, and many days the line of pain up the limb.

“Often the foot had fits of shaking which I could not control.”

She continued thus helpless, using crutches for locomotion, and became thoroughly neurasthenic, until June, 1892, when I saw her in consultation with Dr. Romine. We agreed that the diagnosis was clearly the peculiar painful affection of the fourth metatarso-phalangeal articulation, and that the other symptoms were probably but those of neuritis and reflex neuroses; also, that excision of the joint offered the only means of relief. However, it was determined first to try the effect of an ointment composed of ichthyol and lanolin, together with fly blisters, in the course of the affected nerves. These measures proving of no avail, in July I removed the joint. At the same time it was thought best to divide the tendo Achillis, as the heel had become much drawn up by contraction of the calf muscles, and did not relax even under anæsthesia.

From the moment of operation she never again experienced the old pain, and immediately began to gain flesh and strength under massage, hyper-nutrition, and rest in bed for three weeks. At the expiration of this period she was walking about unaided, and soon as well and strong as ever. Union by first intention was secured, no weakness of the calf resulted, and the amount of retraction of the toe is about one-quarter of an inch. She now wears an ordinary shoe, and can make almost any exertion without discomfort. In August, 1895, she still remained free of the pain.

CASE II.—N. C., aged thirty-two years, female, servant, native of Ireland. Family history negative. Had always

enjoyed good health until October, 1889, when she tripped in going down-stairs, and brought her left foot down violently in saving herself. Instantly she experienced an intense cutting pain in the region of the base of the fourth toe. The dorsum of the foot became black and blue, while the whole limb was affected with a dull burning pain. For several days she wore a slipper; then the discoloration gradually disappeared and pain became more endurable. But she had to cut every shoe that was worn, to prevent pressure upon the painful area. This painful sensation gradually extended from the original location up the front of the tibia, and became very severe in that situation. This misled a prominent surgeon to diagnosticate periostitis of the tibia, and cut down upon and scrape the bone. She remained in the hospital eight weeks, and was discharged unimproved. In February, 1891, another hospital surgeon cut down upon and chiselled away a portion of the tibia. Again no improvement followed.

Early in 1892 the patient entered the Polyclinic Hospital, willing to submit to anything to obtain relief. At this time she was almost helpless, exceedingly neurasthenic, and had lost much flesh. The entire leg was blue and cold and somewhat atrophied, but beyond this nothing was evident except that the fourth metatarso-phalangeal joint and its surroundings were exquisitely sensitive to motion or pressure. From this point the pain was reflected up through the entire sciatic distribution. She was put to bed, and upon a milk diet for four weeks, while local counter-irritants and absorbents were applied, all to but little effect; the old pains and her general nervous condition persisted. I then excised the affected joint, and was amazed at her rapid progress to subsequent cure. Primary union was secured, and in three weeks she was walking about and entirely free from pain. Soon she entirely recovered her former health and strength. Subse-

quently this woman was employed to work a sewing-machine, and metatarsalgia of severe degree developed in the right foot. For this Dr. Thomas G. Morton excised the fourth metatarso-phalangeal joint and amputated the corresponding toe in 1893. In August, 1895, she again applied to me, stating that she was still employed upon a machine, that the fourth toe of the left foot annoyed her by riding or being squeezed upwards and becoming sore by rubbing upon the shoe, and that some neuralgia originated between the third and fourth metatarso-phalangeal joints of the left foot. She desired the third and fourth toes to be removed together with the third metatarso-phalangeal articulation. This I did four months since, securing primary union and complete relief to the present time.*

CASE III.—Mrs. E., aged thirty-five years, well-to-do farmer's wife, seen in consultation with Dr. George L. Romine. Family history good. She is of a neurotic temperament, and faints easily. During last ten years she has been subject to attacks of neuralgia, affecting the left forearm. Three years ago she was seized with neuralgia, affecting the second and third fingers of the left hand. There was tenderness in the metacarpal region, whence pains were reflected up the forearm and arm, producing complete disability of the member. The parts were very painful to the touch, and slightly swollen. This condition persisted for four months, and then gradually disappeared. From this time until June, 1892, she remained well, when a marked attack of metatarsal neuralgia, affecting the fourth toe, supervened. This apparently did not follow an injury. The pain became continuous, and resisted all efforts for its relief, except when she laid down, when it would diminish or entirely disappear. When I saw

* December, 1895.

her, at the end of October, she had become bed-ridden, almost helpless, and exceedingly nervous, but nothing of disease was evident in the foot except the violent, unbearable pain that was invariably produced at the fourth metatarsophalangeal articulation, upon the slightest pressing together or rolling upon each other of the outer metatarsal bones. At this time even the weight of a stocking could not be tolerated upon the foot. The pain extended into the peroneal and sciatic nerves. She had lost fifty pounds in four months. The calf on affected side measured one and a half inches less than its fellow.

The affected joint was excised, primary union secured, and she steadily regained her usual health. Pain disappeared, and she has since enjoyed perfect comfort.

A maternal aunt of Mrs. E. injured her foot eight years ago, and suffered in much the same manner as did the niece. She has never been able to secure relief, and to-day is scarcely able to walk across a room without bringing on a severe attack of the pain.

A sister of the patient injured her foot ten years ago, and was then confined to her room for twelve months, because pain developed whenever the member was placed upon the ground. For five years she was unable to walk upon the street, while at the present time she cannot walk far without originating an attack of metatarsalgia, and has to be extremely cautious in walking over uneven surfaces.

CASE IV.—Mrs. S. C., aged forty-five years, a missionary residing in Japan. She writes:

“When out walking in the city of Tokio, Japan, in the summer of 1888, and wearing a new pair of high-heeled shoes, I felt first a slight pain, which soon increased to severity, in my right foot in the region of the fourth metatarsophalangeal articulation. The pain became so intense that I

could walk no farther. These paroxysms of pain continued to return with the slightest aggravating cause, the disease gradually becoming worse, so that for two years past, when at home, I have seldom had a shoe on my foot, and was not able to bear the loosest shoe while riding in a carriage, being almost always compelled to remove it after entering. When suffering the most intense pain it was accompanied with a general nervousness of my whole system. Upon removing my shoe all pain and nervousness soon ceased."

I removed the affected joint in May, 1892. In three weeks the patient was able to walk about with great freedom in ordinary shoes, and has since remained free of pain.

I have received from Mr. C. a letter dated Tokio, May 5, 1895, in which he says :

"It is now two years since you operated upon my wife's foot for the cure of 'Morton's disease,' removing one joint of the fourth toe. For several years before the operation she had been able to walk but little, and a great portion of the time for two years before, it had been impossible for her to wear a shoe on account of the severe pain which even its weight would cause her.

"Her foot was weak after the removal of the bone, but gradually grew stronger, and none of the old nerve pains have ever returned. She has constantly worn a close-fitting shoe, and last year, in August, walked to the top of the largest active volcano (one of the highest mountains in Japan) without experiencing any inconvenience from her foot."

CASE V.—Mrs. R. T., aged twenty-two years; Canadian; housekeeper. Has suffered for five years from well-marked metatarso-phalangeal neuralgia, involving fourth toe of left foot. No assignable cause. Attacks have been growing more frequent and severe progressively until she became

almost invalided. Was compelled to remove shoe regardless of surroundings instantly upon supervention of the attack.

In December, 1892, I amputated the fourth toe together with the corresponding metatarsal head. In three weeks she was walking about as well as ever, and has been entirely relieved of all discomfort.

CASE VI.—Lizzie T., a Russian; single, aged twenty-two years; mill hand. This woman works the treadle of a machine with right foot. Two years ago began having pain radiating from fourth toe. The frequency and severity of these attacks—necessitating removal of shoe—have increased steadily, until she was entirely unable to work and had difficulty in walking.

In January, 1893, she entered the Polyclinic Hospital, and my resident, Dr. M. W. White, excised the affected joint under my supervision. Primary union occurred, and the cure has been complete.

I could add many more cases which have come under my care since this pamphlet was first published, but as the histories, symptoms, etc., differed but little from the above mentioned, or those cases which follow, multiplication would be tedious as well as useless. Suffice it to say that all have been cured by one or other of the methods of treatment to be described.

Morton * gives the following graphic description of a case of metatarsalgia, written by a medical friend who had been a sufferer from the more severe form of the disease:

“I have suffered intensely at intervals from this affection for many years, and in all this time have never found medical men or layman who understood what I meant when I complained of it or alluded to it. It has been pronounced by

* Loc. cit.

surgeons who have examined my foot to be a sublaxation or a malformation of the articular surface of the first phalanx of the fourth toe, where it articulates with the fourth metatarsal bone, the concavity not being sufficiently concave. This I have long been convinced is an error.

“My own sensations have convinced me that the pain is caused by pressure upon a nerve, but what pressed upon the nerve I was unable to tell. The immediate necessity of removing the boot and the relief afforded by manipulating the foot in a manner learned by experience pointed to a dislocation; but the reduction of the displacement was never sufficiently sudden and marked to confirm the belief that there had been a dislocation.

“Now, after living for more than half a century, practised my profession for over thirty years, and suffered half my life with an affection not understood and ranked with a disease so trifling as a corn, I find myself enlightened and the mystery cleared up by your valuable paper on the subject.

“The first paroxysm occurred in my boyhood, and was produced by tight lacing of skate-straps. On unbuckling the straps, the ‘cramp,’ as I called it, was at first soon relieved and thought nothing of; but a continuance of this system of squeezing by tight straps and tight boots, and riding for hours on horseback with the flexors of the leg and foot in violent action and the toes turned in, the attacks became more frequent, more painful, and the abnormal condition of the parts became chronic. These were in my case undoubtedly the causes predisposing. The causes determining the accession of a paroxysm are the wearing of a badly-fitting boot, especially if the sole be narrow; a long and fatiguing walk, particularly on a hot day over a hot pavement; a long ride on horseback; a wet boot sticking to the sock; a wet sock sticking to the toes; long-continued flexion

of the knee-joint, as in a railroad-car, carriage, or lecture-room; treading on an uneven surface, as a cobble-stone pavement; and, should the nervous system be depressed from any cause, these exciting causes will act more powerfully.

“The symptoms of an attack in my case are most intense pain, ‘cutting to the heart,’ sickening, a feeling that it is unendurable, faintness, cold sweat, total incapacity for the time of directing the mind or will to any other subject, a horrible increase of torture on the use of the boot-jack; and all this with no redness, no swelling, no abrasion of the skin, no callosity, no visible displacement of bones, at least after removal of the boot.

“The suddenness of the attack is noteworthy. I have been obliged to drop everything and remove my boot, sometimes in company, sometimes in my carriage. I have even been obliged to sit down on the curbstone and remove the boot. I have dismounted from my horse and sent home for slippers before I could proceed. I have tied my horse to a tree and lain on the ground, unable to ride farther.

“I have spoken of a tight boot and of removing the boot, but I have had tight boots which were great favorites, because they would not ‘let my toe out of joint.’

“The remedies from which I have obtained relief are removal of the boot and then manipulating the toes, straightening them out. When inconvenient to take off the boot, I have found that grasping the foot tightly round the metatarsal region will answer; and I have sometimes worn a circlet of India-rubber band, binding the foot round the instep. Putting on a dry boot and dry stocking is of great benefit, and the boot should be well sprinkled with powdered soapstone before putting it on. Frequently an attack has been relieved completely without other means than rest and a cup of strong tea.”

Morton also reports the following from another medical friend :

“For several years previous to 1864 I had been subject to occasional dislocations of a relaxed joint in the fourth toe of my right foot. They had always occurred in walking, and the symptoms were perfectly distinct; the reduction, which was usually effected without difficulty, by simply ‘working’ the toe, was equally unmistakable.

“In the summer of that year I was climbing a mountain, when the joint became displaced; and, as it would speedily have slipped out again if reduced, I allowed it to remain luxated until I had finished the ascent and returned to the base, when the pain was so great as to make it necessary for me to ride home. After several hours of suffering, the joint gradually resumed its normal state.

“Since that time I do not remember that the luxation has ever taken place; but I have had many attacks of neuralgic pains in the part, coming on generally after exercise, but sometimes after sitting in one position, as in my carriage. Often exercise does not induce it. Heat, as from the pavements or the sand in summer, is a much more frequent cause. It begins gradually, and sometimes wears away in the same manner, but sometimes vanishes suddenly, as if by magic, without the use of any means of relief. The pressure of a boot always aggravates it; but it has attacked me while in bed at night. Diversion of the mind will often allay it, but it sometimes comes on again afterward with far greater severity.

“In 1869, while spending most of the summer at Atlantic City, I suffered more from this trouble than ever before or since. It would then often come on at night, after a day in town; and once or twice the attacks lasted more than twenty-four hours. So great was the annoyance from it, that I pro-

posed amputation of the toe to a surgical friend, but he advised me against it. Since then it has been much less troublesome, though I have sometimes had it more or less every day for a week.

“Deep pressure over the metatarso phalangeal joint is painful, but does not bring on an attack unless long continued. Cold has given me more effectual relief than any other remedy I have tried.”

The following three cases are quoted from the same source: “In March, 1873, I was asked to see Miss H. S., aged twenty-six years, who, while in Europe four years before, had injured her right foot by stepping upon a small stone. She said that she had at once experienced intense pain, which was soon followed by slight swelling and redness. From the date of the injury localized pain in the foot continued, especially while wearing a shoe. The pain was referred to the head of the fourth metatarsal bone. There was constant distress in the part, often of a sickening character. After wearing a shoe, pain came on with great intensity. At such times the shoe had to be instantly removed, the least delay causing a paroxysm of great suffering. The boot or shoe had to be removed so often that a slipper was substituted. A marked lameness was induced by the patient’s endeavor to spare the foot in walking. The pain was confined to the joint of the fourth metatarsal bone with the base of the associated phalanx. Pressure in this region, or rolling the fourth and fifth toes upon each other, caused violent pain, which extended up the limb. It was severe when pressure was made upon the base of the first phalanx of the fourth toe, which could be prominently felt between the third and fifth toes.”

Dr. M. W. Alison, of Hagerstown, Maryland, called on me in the spring of 1875, seeking relief from neuralgia in his right foot, which had existed for years, and was gradually

getting worse, and stated that he was willing and ready to submit even to amputation of the leg. He gave the following history :

“About six years ago I experienced an unpleasant painful sensation in my right foot, which possibly originated in a strain: the pain was first observed in the fourth metatarsophalangeal region; in the course of a fortnight it was followed by most violent pain, which was simply unbearable and so severe that it terminated in a convulsion. A painful condition of the parts followed, and with the least provocation (wearing a shoe or boot), sometimes without known cause, paroxysms of intense pain returned at various intervals, lasting from one to forty-eight hours. The pain, with one or two exceptions, has been confined to the section of the foot indicated. My suffering has been beyond all comprehension; very often I have been compelled to jump from my buggy or stop while walking, remove my boot, which has always been of ample size, apply ligatures to the limb or foot, use hypodermic injections of morphine, frictions, or call upon some one to assist me by standing on the foot. This affliction has been the burden of my life, and this burden has been increased after consulting many eminent medical men, who gave me no satisfaction as to the nature of the disease, nor even suggested a hope of relief. My health otherwise has been uniformly good. I am satisfied the cases you have had are similar to my own, save in the intensity of my sufferings, and I shall gladly submit to the operation you have suggested.”

Mrs. C. H. K., of this city, a lady fifty years of age, gave me the following history: “‘The queer feeling,’ I have been accustomed to call it, which has been in my left foot for thirty years, is a painful condition. The pain is in and about the joint of the fourth toe, with occasional attacks of intense

suffering, when the pain extends to the knee, and, if my shoe is not instantly removed when the attack comes, the pain reaches the hip. It does not matter whether I wear a large or a small shoe, as I have never worn a tight one, but it seems that the least pressure will produce the same result. Often my sufferings have been exceedingly acute, and come on without any warning. Once I was taken while walking in the street, and the agony was so great that I was compelled to rest on a stoop, remove my shoe, and walk some distance in my stocking alone, the pain running in a straight line to the hip joint. In September, 1868, while at the Academy of Music, I had an unusually severe attack, and, not removing my shoe as quickly as I should have done, was obliged to walk to my carriage without the shoe, and suffered intensely for three hours. My eldest sister has been similarly affected still longer than myself, but in her right foot, same toe and joint. She has several times given up wearing shoes, but the attacks continued."

Charles K. Mills,* in a lecture upon "Pain in the Feet," relates the history of a typical case that was entirely relieved by the operation of Morton. A woman, in jumping upon rocks, twisted her foot. The foot apparently was not injured, and she was soon about as usual. During the next two years, at intervals of from two to eight weeks, a peculiar pain in the foot would develop that would last two or three days. Two years later she injured the foot again in the same manner. After this the pain was seldom absent more than a few days and each recurring attack was of increased violence. Again, two years later, the pain became almost constant. The pain was a dull, heavy, sickening ache from the foot to the hip, and with a sharp pain through the foot. At times the ache would

* Journal Nervous and Mental Diseases, vol. xv. p. 4.

be limited to the foot, but the sharp pain was there constantly. Arising in the morning, the patient could not put her weight upon the foot until she had taken hold of it suddenly from the top and pressed it hard together, and held it in both hands with all her strength for some minutes. After exhausting every known local and general remedy, the fourth metatarso-phalangeal articulation was excised. The patient subsequently slowly became free of every vestige of the former pain, and was entirely restored to health.

Poullisson * describes an instance where a medical man, twenty-nine years of age, had suffered from this affection for some years. It gave no trouble when the foot was at rest and without a shoe, but was usually brought on by wearing boots and walking a good deal. It was much more likely to occur when going down than in going up hill. The pain came on suddenly, a feeling of something having given way in the feet accompanying the onset, together with a kind of grating sensation. After this the patient walked lame, for all pressure of the anterior portion of the sole of the foot to the ground was painful. If walking was persisted in, the pain increased, till in a few moments it attained its maximum, rendering all further attempts at locomotion impossible.

Edmund Roughton † has reported the following case :

“A medical man, aged thirty-three years, complained that for eighteen months he had suffered from attacks of burning pain in the forepart of the sole of the left foot. The pain occurred several times a week, and was usually brought on by prolonged standing or by walking any considerable distance, and was so severe as sometimes to cause him to remove his boot and grasp the sole of his foot with his hand.

* Loc. cit.

† London Lancet, March 16, 1889, p. 553.

On examining the foot I found that the transverse arch formed by the heads of the metatarsal bones had sunk, so that a distinct convexity replaced the concavity normally found in this situation.

“In this case the patient had increased considerably in weight during the period of development of the symptoms, and his transverse metatarsal ligament had presumably been unequal to the increased strain.”

E. H. Bradford * has reported a series of thirteen cases, none of which, however, were severe enough to demand operation. In these the symptoms were not in a single instance the result of traumatism, nor was any evidence of dislocation or other local change observable. These patients were all in enjoyment of excellent health, and in none were there evidences of gout or rheumatism.

As demonstrating the extreme conditions that may follow or accompany the severer varieties of metatarsalgia, I quote, without abbreviation, the report of an extraordinary case by Dr. O. T. Osborne, † of New Haven, Connecticut:

“In November, 1893, a young woman, about twenty-five years of age, came under my care, complaining of pain in the right foot, with a feeling of numbness in and often a cramping of the fourth toe. The pain was increased by walking and going down-stairs, and when sitting still often the shoe must be removed to relieve it. The pain was of a sickening, boring character, often shooting around the ankle and up the leg.

“The history of the patient was as follows: In December, 1892, she had slipped on a piece of coal, turned her ankle,

* Loc. cit.

† “A Case of Morton’s Metatarsalgia; Neuritis; Exsection of Joint; Cure.”
New York Medical Journal, August 31, 1895, p. 271.

and fallen on her right hip, with the foot twisted under her. For a week she walked with difficulty, due to the strain and soreness of the whole leg. About one month afterwards—viz., in January, 1893—she had a cerebro-spinal meningitis, during which both ankles became stiff and the leg muscles contracted, so that the feet were turned in and down, greatly out of shape. On recovery, after remaining in bed nearly two months, she was hardly able to walk, owing to the stiffened ankle-joints and to the contractures of the muscles of the legs.

“In June, 1893, she was first able to walk well, but typhoid fever again put her to bed in the latter part of July, and kept her there until she first went out in October. At this time the right foot began to pain her badly, was numb, and caused her trouble in walking.

“In November, when she first came to me, as above stated, I found almost total anæsthesia of the fourth and fifth toes of the right foot, and slight anæsthesia of the skin along the course of the external plantar nerve. There were also tender points along the course of the sciatic nerve and in the popliteal space.

“The diagnosis of neuritis in a subacute stage was made. Electrical treatment was started, and quickly, by the constant current, the anæsthesia disappeared; as for the pain, the interrupted current always caused a diminution of it, but the periods of absence of pain were always irregular and evanescent.

“The pain was always increased by walking or going up and down stairs. All medicinal treatment utterly failed, and at times there was a great deal of sciatic pain, even to the hip, and often in the knee.

“Every resource was tried to cure the patient, but the only relief, or rather the only treatment that seemed to prevent

the pain from being unbearable, was the constant current, to reddening of the skin, over the painful points of the sciatic nerve, and the interrupted current to the foot and toes. This treatment was continued at short intervals until October, 1894, during all of which period walking was always more or less painful, and the shoe must be loosened or actually removed, at almost any place, be it church or theatre, if she had sat quietly for a time. Morton maintains that this compelled removal of the shoe is a diagnostic sign of this metatarsalgia.

“In October, 1894, after some unusual amount of going up and down stairs, and after several previous aborted attacks, a violent ascending neuritis of the sciatic nerve started up. This was the most violent and intensely painful sciatic neuritis that I have ever seen.

“The fixation splint from the heel to the axilla was constantly kept in place, with occasional removals for the relief of pressure points and for the reapplication of cotton and flannel for dry warmth. Hot sand-bags were constantly used about the legs, as dry heat diminished the amount of the pain.

“During the paroxysms of pain always, and constantly for four weeks, hypodermics of morphine in enormous dosage were given. Nothing else was of any avail.

“For five weeks these paroxysms occurred almost daily, and at these times individual muscles or groups of muscles of this (right) leg would be thrown into contractions, both clonic and even tonic in character. Often these contractions would affect the back and abdominal muscles on the right side, and even opisthotonus often occurred. These convulsions of the leg and hip muscles caused excruciating pain, as every twist or pull would injure the inflamed sciatic nerve, so that the patient begged for the attendants to hold the leg

still, as even in the splint the joints were slightly moved by the muscular spasm.

“ At any time, if the splint was momentarily removed, the toes and foot flexed spasmodically towards the plantar surface, always causing agonizing pain.

“ Nothing stopped these spasmodic, convulsive paroxysms but inhalations of chloroform to partial anæsthesia and kept up for half an hour at least. Then relaxation enough would occur; for the powerful hypodermics of morphine, without endangering the life of the patient, could not be given to prevent these paroxysms, although three grains were often given in a night, and frequently one grain and three-fourths at one dose, and that to a patient who had never taken morphine up to the time of this acute neuritis. All of the surface of the foot and leg receiving nervous filaments from the external plantar and posterior tibial nerves was anæsthetic, but any movement or any pressure that would affect any part of the sciatic nerve would cause intense pain, and perhaps precipitate a paroxysm.

“ During this attack of neuritis, the most painful region, and the point that could not bear even the touch of a finger, was on the sole of the foot at the joint of the metatarsal bone and proximal phalanx of the fourth toe.

“ As here was the point of most intense pain, and as injury to this part by walking and going down stairs could be the cause of the traumatic ascending neuritis which I decided that she had, I concluded that there was either a neuroma at this point or that she had Morton's metatarsalgia as the cause of the whole trouble, and that only surgical interference could ultimately cure the patient. I at this time stated my opinion to the family, and the subsequent operation proved the condition to be that described by Morton.

“ In seven weeks the acute stage had passed and the patient

was about on crutches, as the muscles supplied by the posterior tibial nerve were paralyzed as well as the fourth and fifth toes. The skin supplied by the posterior tibial and the external plantar nerves was anæsthetic, while movement of the ankle-joint was very painful. With massage and electricity the sensation became normal, and the paralyzed muscles of the leg returned to normal action by about January 15, 1895. But now again we had the same old plantar neuralgia, and the same aching toes and leg, and the same inability to walk.

“As soon a threatening sciatic pain after a little extra use of the foot compelled me to send her to bed for three or four days, I called in Dr. William H. Carmalt as consultant, as I desired surgical interference. Dr. Carmalt agreed with me as to the trouble being Morton’s neuralgia, and exsection of the joint was decided upon. The operation was performed by Dr. Carmalt in March, 1895, and was perfectly successful. From that date up to the present time there has been entire and complete absence of pain from the toes, foot, leg, and thigh. There has been no pain in walking or going downstairs, and no cause to remove the shoe. The atrophy of the leg, which had in considerable measure persisted since the attack of neuritis, has entirely disappeared.”

TREATMENT.—The less severe forms of metatarsalgia may often be prevented from running into the more serious types by proper shoe construction, or by wearing a narrow flannel bandage about the ball of the foot. Morton, whose suggestion the latter is, directs that the bandage be two inches wide, and long enough to wrap neatly and firmly about the metatarsus some five or six times. The end is pinned, and the stocking drawn over. This has given marked relief in a number of cases.

The shoes for persons suffering from this disease should be firm-soled, make no lateral pressure upon the metatarsus, yet have the instep tight enough to prevent the foot slipping forward. The great object of the shoemaker should be to prevent pressure, either lateral or antero-posterior, upon the metatarsal arch, and also to prevent any rolling motion of the outer metatarsal heads upon their fellows. A broad, rigid sole would appear to best fulfil this last indication. Bradford proposes the use of digitated stockings in these cases, with a view of keeping the toes farther apart. As the foot spreads when the weight of the body is thrown upon the member, it is apparent that the individual should be standing when the measurements for shoes are made, as has been advised by Grün. Use of shoes made upon a high-instep or Spanish last, as suggested by Gibney (p. 7), has proved of value in some cases.

The use of various pads in the shoe and about the toes, also such measures as the hollowing out of cavities in the sole opposite one or more of the metatarsal heads, have been tried, but invariably found unsatisfactory. A variety of the affection calling for so much attention to secure comfort would clearly demand the certain cure to be afforded by operation.

In persons where rheumatic or gouty diathesis may be suspected, appropriate remedies for those disorders should be given a thorough trial before operative measures are resorted to. But when the condition is entirely of local mechanical origin the employment of general or local medicinal agents is useless. On the other hand, prolonged rest in bed will benefit all cases more or less, and occasionally secure relief for long periods, or even permanently cure the milder phases of the disorder.

Operative treatment should be limited to excision of the

metatarso-phalangeal articulation from which the neuralgia radiates, or, perhaps, to amputation of the corresponding toe above the joint, as have been recommended by Morton and endorsed by other writers. These procedures are among the safest and simplest in surgery. Of amputation of the toe, together with its metatarsal head, nothing more need be said than that by this measure the possibility of subsequent trouble arising from a tendency of the toe to retract and ride above or below its fellows is excluded. However, this heretofore occasionally troublesome sequel can generally be avoided by dividing the extensor and flexor tendons of the toe while excising the joint, as I have done in many cases with satisfactory results. But where the patient is willing, I always amputate the toe, so as to prevent absolutely any possibility of trouble from up-riding of the member. I have now under care a lady who had the fourth joint in each foot removed for severe double metatarsalgia some ten years ago by another surgeon. No pain has ever returned, but she has been so annoyed by the toes being squeezed upwards by lateral pressure of their fellows that she demanded that they both be amputated. The deformity resulting from amputation of the fourth toe with its metatarso-phalangeal joint is exceedingly slight, as the remaining toes soon approximate each other and obliterate largely the space formerly occupied by the ablated digit.

Dr. A. E. Hoadley* reports a successful case of metatarsalgia five years after operation by excision of the digital nerves of the fourth toe through an incision in the sole of the foot. Although the success of this single case is unquestioned, I do not see anything to commend the method. It must be more difficult and less certain than that to be recom-

* Chicago Medical Recorder, July, 1893.

mended, does not prevent recurrence should the nerves regenerate, and has the great disadvantage of leaving an extensive scar upon the ball of the sole of the foot.

Operation.—Primary union should be aimed at. To secure this the foot must be scrupulously cleansed. The nails should be trimmed short. Then soap, water, and nail-brush should be liberally applied. Following this the member should be soaked in two-and-one-half per cent. carbolic acid solution, and finally dressed in a moist carbolic dressing of the same strength until the surgeon is about to operate. Where the foot is especially foul, it is my custom to finally dip it into a saturated solution of permanganate of potash until colored to a dark mahogany hue, and then transfer it to a saturated solution of oxalic acid until decolorized, before applying the temporary dressing. When the surgeon is about to operate, the temporary dressing is removed and the parts given a final douche with 1-1000 sublimate solution.

A vertical incision from one and a half to two inches long is made, beginning over the proximal inter-phalangeal joint and extending upward in the centre line of the toe.* The extensor tendon now comes into view, and is divided. Another stroke of the knife carries the incision through its entire length down to the bone. The handle of the knife or other moderately blunt implement is then employed to separate the tissues from the upper and lateral portions of the joint. Next the blades of a powerful sharp-pointed, narrow-bladed cutting pliers are pushed down on either side of the phalanx immediately below its base (hollow of the blades always towards the articulation), and this bone divided. The

* This joint has also been excised through an incision in the sole, but the method is objectionable on many grounds.

metatarsal bone is then similarly divided just above its head. The separated joint is now seized by bone forceps and dissected away from any remaining attachments. This done, the flexor tendons will be seen lying in the bottom of the wound, and should be picked up by forceps and divided with scissors. If hemorrhage is severe and not controllable by moderate compression of the parts, ligatures should be applied. I have never had occasion to apply a ligature in this operation, as the pressure of the dressing has always sufficed to control any oozing that might continue after the sutures had been applied. The wounded edges are next to be approximated—no drainage being required if asepsis has been maintained—by continuous or interrupted suture, as may be preferred. A gauze and cotton dressing is finally applied and bound firmly on with a wet gauze roller, care being observed to place little pads of the gauze in such positions as will hold the toe in its proper position during healing.

The foot should be kept considerably elevated for the first two days, after which it may be brought to the level of the bed. I prefer my cases to remain in bed or on a couch until the fourth or fifth day, when they may be permitted to sit up with the foot resting on a chair. At the end of a week the sutures, if not catgut, are removed; two or three days after which the patient is permitted to move cautiously around, while at the termination of three weeks all restraint may be removed and a firmly healed wound and permanent cure confidently expected. No special form of shoe or particular care of the foot is afterward required.

In case suppuration should arise in the wound, the sutures should be at once removed, the wound cavity washed out with full strength peroxide of hydrogen solution, then with 1-1000 corrosive sublimate solution, and gently stuffed with acetanilid or iodoform gauze. All of which should be re-

peated every one or two days until the wound closes by granulation.

In addition to the references given in the text, the following may be mentioned to complete the bibliography of the subject:

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1506 LOCUST STREET,
PHILADELPHIA.

