AMPUTATIONS PROTHETICALLY CONSIDERED.

Printed in NEW YORK MEDICAL JOURNAL,
January 27th, 1894.

AMPUTATIONS

PROTHETICALLY CONSIDERED.

BY

GEORGE E. MARKS, A. M.

READ BEFORE THE SECTION IN MILITARY MEDICINE AND SURGERY OF THE FIRST PAN-AMERICAN MEDICAL CONGRESS.

INTERCOURSE with a considerable number of surgeons—those who reside in the centers of prothetical industry as well as those who inhabit more remote parts—discloses a lamentable absence of knowlege on the subject of amputations when viewed in the light of prothesis.

In consequence of a want of familiarity with this aspect of the subject, we artificial-limb makers have frequently brought to our presence

stumps that are good, bad, and indifferent; stumps that could have been better; stumps that reflect credit, discredit, and no credit on the surgeons who performed the amputations, or on those who attended to them after the amputations were performed; stumps that can readily be inserted into artificial limbs with the assurance that no trouble will follow and that the possessors will live in the sublime consolation of having realized the removal of their disabilities for all practical purposes; stumps that might have been better and would have been beyond criticism had the operators taken advantage of opportunities which familiarity with prothetical methods would have revealed to them.

The time has arrived when this subject should receive more thought and when prothetical knowledge should be more widely disseminated.

I can see in the not very distant future the subject of prothesis embraced in the curricula of the schools and colleges of surgery, when a graduate will be equipped with all the information requisite to guide him to not only amputate properly, but to put the stump in the most favorable condition for the prothetician; to take measurements, diagrams, and casts when necessary, to enable his patient to obtain a suitable appendage with the least delay; when his knowledge

will enable him to detect defects in adjustment and to remove them ; to prescribe changes that may be required in an artificial limb to accommodate changes that may take place in a stump. As surgeons will always be more numerous than leg makers, it is all the more important that their information on this subject should be broad and thorough.

I shall discuss the subject of Amputations Prothetically Considered from but a few standpoints, confining myself to amputations of the lower limbs only.

1. Length of Stumps.—Any stump that is well covered with integumentary tissue can not be too long. I am well aware that when I advance this proposition I antagonize the views of those artifical limb makers who have not kept abreast of the times, and am controverting the rules that have been laid down by some writers of repute on the subject.

Artifical limb makers not many years ago, almost to a unit, decried the amputation of a leg below the junction of the lower and middle third, or "the point of election" so called, and were pronounced in their utterances against all ankle and partial foot amputations.

The methods which were then employed produced artifical legs that were not capable of

adaptation to long stumps, particularly to stumps that extended to the ankles or below the tarsus. I may add that this adverse opinion on long stumps is still held by some prothetícians, notwithstanding the fact that great departures have been made during the past decade or two in prothetical methods. When a leg maker of modern times says that an amputation should not be made below the point of election, you may regard him as confessing that he has not the ability to make a leg that can be worn on a long stump.

To-day artifical legs are made that can be worn on stumps of any length—tibio-tarsal, medio-tarsal, and tarso-metatarsal not excepted. Any stump that is capable of bearing weight on the extremity is preferable to one that can not. A tibio-tarsal amputation made after the method of Mr. Syme produces an end-bearing stump, and can be placed in the category of "the most favorable". An amputation after Dr. Pirogoff's method is also productive of an end-bearing stump, provided the os-calcis is properly placed and united to the tibia or securely held in the intermalleolar space. An amputation in the tarsus or at the tarso-metatarsal junction after any of the methods of Chopart, Lisfranc, Hancock, or Hey, is productive of a stump that is capable of being treated prothetically.

In every partial foot amputation care should be exercised to prevent the contraction of the tendo Achillis ; usually lashing in a suitably contrived splint will suffice. If this means will not accomplish the object, either tenotomy or fixation of the ankle joint should be resorted to, for if the heel is allowed to draw up and the amputated surface point downwardly, the possessor of that stump will be obliged to have an artificial leg applied that will not touch, but that will shield the amputated surface ; this means that the artificial leg will elongate that side and necessitate the wearing of a thick sole and heel on the shoe worn on the well or companion foot. Such a stump ceases to be an end-bearing stump and its disadvantages are apparent.

I have a horror for those modifications of Chopart's and Pirogoff's operations that do not provide flaps on which the weight of the subjects can be endured. A case was brought to my attention some years ago which I can opportunely refer to here. A young man, a farmer by occupation, residing in Vermont, had his foot crushed. Amputation was deemed necessary. A modification of Chopart's operation was performed. The stump that resulted presented the appearance of an inverted cone, the apex scantily covered with tissue and extremely sensitive.

This stump was hopelessly an end-bearing stump and had to be treated the same as if amputation had been made above the ankle. It is obvious that inasmuch as a Chopart's operation could not have been performed, a Pirogoff's or a Syme's or even an amputation above the ankle, would have given the patient a much better stump. This illustrates the importance of amputating for an end-bearing stump in a way to save the continuity of bone and to obtain an ample flap, even if the tarsus has to be sacrificed.

The advantages of a totally or partially amputated foot, producing an end-bearing stump, over a leg amputation are many. The more important are the following :

1. An artificial leg for an ankle or partial foot amputation costs only half the standard price of an artificial leg for an amputation above the ankle.

2. An artificial leg for any of the above end-bearing stumps does not incase as much of the leg and thigh as an artificial leg for an amputation above the ankle.

3. The possessor of a stump extending to the ankle can improvise a sheath with suitable pad on which he can rest his stump and walk tolerably well ; or if his stump extends to the

metatarsus and he has a portion of the plantar surface of the foot left, he can walk and get about quite well without any contrivance. These are vital considerations for the poor man, and should be regarded by the surgeon.

The most modern and approved artificial legs for ankle and partial foot amputations provide phalangeal support, which will readily be conceded as absolutely necessary to aid progression and prevent limping. The absence of phalangeal support as always felt by those who do without prothetical assistance.

During the past two years I have personally superintended the construction and application of over three hundred legs designed for stumps that have followed tibio-tarsal, medio-tarsal, and tarso-metatarsal amputations. During the existence of the house of which I am a member (A. A. Marks.) over fourteen thousend subjects, with amputations at various points of leg, thigh, and arm, have been supplied with artificial limbs. Most of them have come under my personal supervision. With this experience I feel myself competent to say that long stumps with ample flaps, that stumps resulting from tibio-tarsal, medio-tarsal, and tarso-metatarsal amputations, can be supplied with artificial legs that will be com-

fortable and pleasant to wear, and that will restore the wearers to the amplitude of their usefulness.

A stump extending below the knee is preferable to a stump extending to the knee, provided the stump is capable of flexion and extension. If the stump is disposed to become extended and ankylosed, it will be preferable to sacrifice the leg to the knee.

I had occasion to share the regrets of a subject that was brought to my office not many years ago. This man's leg had been amputated about four inches below the knee articulation; the stump was extended and ankylosed. To make an artificial leg for him would necessitate a rigid knee in the artificial or an articulating knee out of parallelism by about four inches with the natural knee. Either would place the fellow at a disadvantage, especially when sitting. If in the amputation of this leg the operator had had any indication that his patient's stump would have become extended and ankylosed, he would have displayed greater wisdom if he had amputated through the knee articulation. Any amputation below the knee should, as far as possible, be made with proper regard to the preservation of full knee mobility, and during the recuperative period the knee should occasionally be forced

into action, so as to prevent impairment of the power of flexion and extension.

A stump extending to the knee is preferable to a shorter stump. The condyles and nodules of the femur should never be excised in knee disarticulations. The nodules afford means for securing an artificial leg, and the condyles and articular surfaces are better prepared by nature to endure pressure then the saw or the knife can prepare them.

If the patella can be placed in the intercondylar space and properly secured, it is always desirable to do so.

The foregoing, I hope, will serve as an appeal to every operating surgeon to sacrifice as little of the human limb as possible, giving a proper regard to the securing of integumentary tissue for the purpose of covering the extremity and protecting the partly excised bones. These are certainly the teachings of the wisest and most conservative surgeons of the past, and I know of no reason why they should now be relegated to obsolescence.

2. *Flaps.*—All stumps should be provided with ample flaps, not redundant flaps. A redundance of tissue on the extremity of a stump is no advantage. The prime office of a flap is

to protect the extremity of the bones, and they should be only ample to effectually perform that function ; whether the flaps are anterior or posterior, exterior or interior, or a combination of any of the four, it matters not, so long as the extremities are well protected. Periosteal flaps are desirable, as they give additional protection to the bones and prevent integumentary flaps from becoming adhered to the bones

If an amputation is to be done below the middle third of the leg, bone should be sacrificed in order to obtain suitable flap. If the amputation is to be made above the middle third bone should not be sacrificed, even if transplantation is necessary in order to secure flap. Every inch of healthy bone above the middle third is desirable for leverage purposes. If a thigh amputation is to be done close to the knee, bone can be sacrificed in order to secure flap. The nearer the amputation is to be done to the body, the greater should be the care to save bone.

3. The Disposition of Cicatrices.—The rules established by all the accepted authorities on ankle and partial foot amputations should be rigorously observed. By so doing the disposition of the cicatrices will be the most advantageous for prothetical purposes.

In all amputations of the leg and thigh as well as knee disarticulations the cicatrices should as far as possible, be placed well away from the extremities of the bones and preferably along the posterior aspects. Contiguity or adhesion of the cicatrix with the extremity of a bone is frequently the cause of suffering.

4. Treatment of Stumps after they have become healed.—A stump, before it is called upon to perform the functions of operating an artificial limb, is an inactive remnant of an active member of the body. On account of its inactivity, it becomes disposed to accumulate adipose tissue, and, if permitted to do so, it will become abnormally large and œdematous. If possible, this growth or condition should not be permitted. Usually tight bandages will prevent it. The bandages should be applied from the time the stump has healed until the artificial limb is applied. The bandages should be as tightly drawn as possible and not interfere with circulation. The bandages should be applied in the usual way, beginning at the extremity of the stump and continued the entire length of the complete section of the limb above the stump. This means for a partial foot amputation that the bandage should be carried to the knee, and for a leg amputation that the bandage should be carried to the body.

I have frequently met surgeons who incline to the belief that an attenuated stump should not be allowed, on the contrary it should be encouraged to grow so as to possess the dimensions of the companion leg before an artificial limb is applied. This certainly would be desirable if such growth would permanently and effectually resist the influence that an artificial leg will exert on the stump to reduce it.

It can be stated for a certainty that an artificial leg will harden, solidify, and diminish any stump. In consequence of this, it is desirable to keep the stump as small as possible so as to minimize the changes that will follow the application and wearing of a leg.

5. *Time to apply an Artificial Leg.*—It will be safe to apply an artificial leg to a stump that has resulted from traumatic causes as soon after the healing of the stump and the recovery of the patient to his normal vigor as possible. Nothing can be gained by waiting beyond that time. Waiting entails a loss of time and permits the stump to become enervated from disuse.

A stump that is the result of disease, especially if of a malignant nature, should be obliged to wait until there is a certainty that the pressure, confinement, and concussion tnat follows, more

especially the initial operations on an artificial leg, will not excite a recurrence of the disease.

A child who has lost a leg is never too young to have an artificial leg applied. It should be observed that the tissues, bones and articulations of an infant or a growing child must be forced into repeated action in order to become developed, healthy and vigorous.

To hobble about on one crutch or a pair of crutches for a number of years is rather a severe and inhumane punishment to impose on a child because he is growing. An artificial leg of modern construction can be lengthened from time to time at a very slight expense, and as an artificial leg provides the nearest approach to a natural prop for the amputated side, it is the only means that will encourage healthful growth and symmetrical development.

To illustrate this fact, I can do no better than present the case of an infant brought to me by Dr. Bacon of New Haven, Conn. The child was not quite nine months old when I took her in charge. Her leg had been amputated two inches below the knee for congenital causes The stump tended to flex and remain so ; ankylosis was feared. I applied a neat-fitting leg with knee articulation. The artificial leg held

the stump in extended and flexed positions, according to the manner in which the child was held or placed. In a few months the child began to creep, a few months later she was able to stand, and later still she learned to walk. The artificial leg assisted her in all these operations of progression. She developed rapidly and symmetrically, and to-day she is a young lady of comely proportions, enjoying good health, walking as gracefully as one in possession of Nature's limbs—a testimony of the wisdom of applying artificial limbs to the young when misfortune has deprived them of their share of extremities.

Jn the summer of 1893, Geo. M. Sternberg, M. D., Surgeon General of the United States Army, and the Executive President of the Section on Military Medicine and Surgery of the Pan-American Medical Congress, invited me to read a Paper before the Congress on "Amputations Viewed by an Artificial Limb Maker."

I esteemed the compliment on account of the eminence of its origin and felt that an op-

portunity had been presented which I should not allow to slip, that of presenting to the profession at large some deductions on amputations which I had made in the prosecution of my profession. The foregoing paper was hastily prepared and read before the Pan-American Medical Congress in Washington, D. C., on the 7th of September, 1893. Subsequently it was published in the New York Medical Journal and other medical publications.

On account of the many letters which have come to me from surgeons from this as well as foreign countries, asking for copies of the paper, I have deemed it expedient to put the paper in pamphlet form and allow a generous distribution.

It should be noted that the essence of the paper approves of the conservatism of the older authorities in sacrificing as little of the human body as possible, depending upon the willingness, ingenuity and skill of the prothetician to substitute that which had been removed. The failures of many protheticians in devising desirable substitutes for long stumps have caused some authorities to utter voices of condemnation on amputations that admit of stumps extending below the "Point of Election," claiming that such

stumps are ill-suited for the wearing of artificial limbs and therefore should not be made. I hope the foregoing paper will successfully controvert that fallacy.

GEO. E. MARKS,
701 Broadway,
New York City.

Member of the Firm of
A. A. MARKS,
Inventors & Manufacturers of
Artificial Limbs
with
Rubber Hands and Feet.

Date, ...

To A. A. MARKS, 701 Broadway, New York City.

Dear Sir:—Forward to me, free of charge, a copy of MARKS' TREATISE ON ARTIFICIAL LIMBS, containing 430 pages, with 300 illustrations. Respectfully yours,

Name .....

Street and No. .....

City or P. O. .....

County .....

State .....

ANSWER THESE QUESTIONS.

Where is limb amputated? In the ankle, above the ankle, in the knee or above the knee, in the wrist, above the wrist, or above the elbow?

Answer .....

.....

Date of amputation .....

Have you ever worn an Artificial Limb? .....

Remarks .....

.....

.....

We also publish books in French, Spanish and German. If you wish a copy, kindly make the request.