Self-Adjustable and Inflatable Air Stump Socket

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AUTHOR'S PREFACE

This is an article about a new technic to fit artificial limbs and prostheses. It is, in fact, not a new idea at all because pneumatic and liquid filled sockets have been patented before, but they have never worked out to satisfaction and soon were forgotten.

I have analyzed the faults and shortcomings of the first sockets and by using entirely different materials and methods, I do feel the adjustable pneumatic stump sockets should and could be of great benefit to the amputees and the prosthetists.

I do not expect that my idea will be accepted 100 per cent without pro and con, but, in all fairness to progress, I hope it will stir up enough interest to discuss it and give it a chance to be approved or disapproved.

My motto always has been to try any new idea first before condemning it and help progress along. Therefore, I beg your indulgence in judging this matter because I am of the opinion that amputees and limb fitters would gain immensely if this method could be adopted in general and the known difficulties in fitting of artificial prostheses could be lessened and avoided.

In more than 50 years of professional limb and brace fitting, I have worked and tried all known technics, but at the same time I have kept my eyes open for new items and progress and therefore took great interest in all the V.A. and Government inspired and sponsored new developments in the orthopedic field. I myself and my eager young men in the shop have attended and followed most of the University Programs and we all are proud to belong to the respected and progressive shops in the U.S.A.

Looking back to 1937 when my family and I came to the U.S.A., I was ready to demonstrate the suction sockets because I had made and fitted a number of them. However, America was not ready for it until the U.S.A. Occupation Army reported the progress in Germany. This development has been one of the biggest boons in the history for all amputees. Here also was a pro and con suspicion and animosity prevailed until it succeeded.

I am merely mentioning these facts to recall the resistance and unwillingness to accept the suction socket which seems impossible today to have ever happened. It should remind us also that we should approach and judge a new idea and development with open eyes and willingness to try before turning our back to it.

It is up to our clear and logical thinking colleagues, patients, scientists and sponsors to help this idea along, and I hope the self adjustable pneumatic stump socket will eventually find its place in the orthopedic field like the suction socket and other newly developed and accepted items.

THE INFLATABLE SOCKET

For a long time it has been on my mind to simplify the method of fitting artificial limbs to amputee stumps by means of a new and different approach.

In the past, the limb fitter who was not a trained or certified orthopedic man used only primitive measurements to carve out the wooden socket which is a container for the stump. Later a more accurate fitting was obtained by using a plaster of paris negative and positive as model. However, even the best fitting artificial prostheses can be very uncomfortable because of certain conditions such as changes in the stump, shrinkage, or weather conditions. Increasing age also tends to have its influence on the amputee, and all these factors combined can sometimes make the use of an artificial leg unbearable.

Ordinarily wool stump socks will act as cushioning shock absorbers between stump and limb socket. But very often the stump and its bony parts are so tender and sore that not even wool socks or other liners will help to relieve the discomfort. Since I had been familiar with these problems for many years, I came to the conclusion that better techniques and materials must be found to make the patient comfortable and also to give him a chance to adjust the socket to his own liking at any time.

My idea, which I experimented with in my home shop for several years, has to do with an air inflated and adjustable stump socket which will let the stump practically float on air and thus avoid direct contact between the bony and tender parts of the stump and the hard walls of the artificial leg.

Since the idea of using inflated pads or sockets was not new and patents on it had been issued, I had to find out why they had failed and find the answer to problems which mostly concerned the right kind of materials. I must point out that my socket is not just a double wall tubing affair with a certain air pressure that surrounds the stump in the socket. It is not a fluid-lined socket either. Ordinary pneumatic sockets with only air as filler do not feel comfortable and alive, and the same goes for the fluid-filled sockets.

Fig. 1. Single wood socket with pneumatic inner socket installed. The hand pump is attached to the valve to inflate the stump socket from the front of the leg.

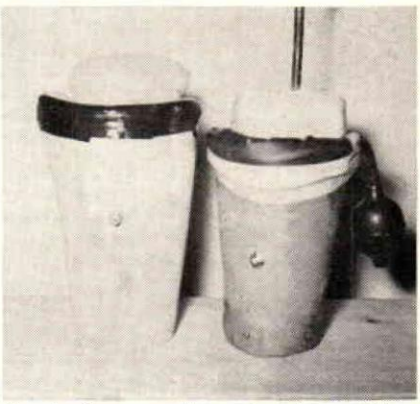

Fig. 2. Same wooden socket shown with a leather inner socket with ball pump attached to hose which is installed in the adjustable socket at the brim so that inflation is easier in some cases.

Both elements, when under load pressure, create a somewhat unreal, bumpy and uncomfortable feeling because they shift and move too much, and the stump loses contact and security. In order to avoid this feeling, I arranged as the most important factor in the socket a full size layer of porous plastic foam (Polyurethane) between the two walls which acts as a liner or pressure and shock absorber. The thickness of this foam liner varies according to the fleshy or bony nature of the stump and how much room is available between the stump and the inner wall of the prosthesis. Of equal importance is the one-sided adhesion of the foam liner to the wall of the socket next to the stump. Thus, when air is pumped into the socket, the foam liner will firmly surround and protect the stump like an ordinary liner, while the air between simply acts as an adjusting factor to regulate shrinkage or expansion of the stump. This problem can be solved with the help of a small ball hand pump and is easily handled by the patient himself. It is particularly helpful for new amputations which tend to shrink very fast sometimes, and in diabetic cases when too much pressure causes dangerous skin ulcers and infections. In such cases the amputee has only two alternatives: First, wear more stump socks to fill in the empty space in the socket; or Second, have the limb shop install leather felt or plastic liners and re-fit the stump again and again until the prosthesis is comfortable. This process, however, may have to be repeated several times during the process of shrinking and is always time-consuming and costly. To avoid all this the inflatable air socket can be fitted right into the new artificial limb when it is constructed or can be added later. It is also possible to make and install smaller air pads wherever they are needed to protect bony parts like ends of stumps, tibia and fibula, condyles, Choparts, and Pyrogoffs, ischium and disarticulation cases. Above-knee amputations and upper extremity cases could also be served; and with bottoms closed and sealed, A.K. and B.K. legs could be fitted as suction legs.

In designing this socket, I joined and air-sealed two layers of a special plastic sheet material from which I made a bag, attached a valve, filled and pressurized it with air, and submerged it in a bucket of water where I kept it under weight for over a year. The material I use is the only one that stood up among dozens of other sheet materials. Therefore I favor it until something better can be found.

Inside, between the two layers, is a sheet of porous air foam (Polyurethane) which is glued to the layer next to the prosthesis and expands when air is pumped into the socket. The porous plastic foam allows the air to circulate freely in an even flow so there will be pressure all around the stump and, at the same time, an additional cushion. A piece of plastic tubing is welded between the two layers of plastic sheeting and the open end of the tubing contains the air valve which is operated by the small air pump. Or a different valve with a short stem can be installed directly into the adjustable socket, protruding through a hole to the outside of the limb shank to allow easy access to the ball pump. The simplicity of operating the inflatable air socket is quite obvious and almost any amputee should be able to inflate or deflate the socket after being shown how by the limb maker. The small ball hand pump can be carried in a coat pocket, a woman's purse, or in the hollow space on the prosthesis below the stump end. It attaches easily to the valve.

It is my firm belief that these adjustable air stump sockets can be made in standard sizes and carried by the artificial limb shops for installation at any time. They can be made in closed tubing shapes, with or without closed bottoms, or in open fashion with one or two inches of overlap for

easy fitting into the sockets of the legs. Another possibility is to cover one side with some adhesive, like band-aid's, which would allow the leg maker to install the socket without fuss and then cut away the overlap margin. There would be no objection to the patient wearing wool or cotton stump socks if he so desires. Furthermore, the adjustable socket could be used as a stump shrinker in new amputation cases and to replace elastic bandages which have a tendency to loosen and slide off the stump if not properly applied. The circular air pressure is easy to control and can be handled by the patient himself, while the wrapping process with the elastic bandage would require another person's help.

VA Office in Rome Serves 21 Countries

Approximately 16,000 VA beneficiaries in 21 European countries now are being served by the newly opened Veterans Administration Office in Rome, Italy. Manager of the office is Mr. Gordon Elliott, former Manager of the Philadelphia Regional Office of the VA.

The office was officially opened April 1, 1963, and is manned by four Americans and five Italian nationals. The Americans, in addition to Mr. Elliott, are Elizabeth Sommer, formerly of the Central Office of VA; Benefits Specialist Peter Basone; and Administrative Officer Robert Heathman.

The Department of Data Management has provided the Rome Office with a breakdown of every Europe-residenced service-connected veteran, pensioner and other beneficiary by name, claim number, and other data necessary to authorize immediate service.

Expenditures of some $17 million are being paid annually with 60% of the outlay presently being distributed in Italy and Greece.

The VA Office for Europe is authorized by Public Law 87-815. Prior to enactment of this law in October 1962, veterans living in Europe were not eligible for VA medical benefits if they were permanently residing abroad. The new law, however, requires only that the veteran be a citizen of the United States and that the condition for which he requires hospitalization or outpatient treatment be related (service-connected) to his military service.