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Extra-Ambulatory Activities and the Amputee

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Extra-ambulatory activities and their use in the treatment of amputated individuals have received considerable publicity. Initially motivated by a personal drive for physical accomplishment, many patients have discovered unsuspected levels of performance. It is this high level of performance, combined with the sense of personal accomplishment, that has captured the public's attention.

The purpose of this article is to examine the need for physical exercise among amputees in hopes of making such activities the norm rather than the exception in rehabilitation and daily activities. To better understand the physical limitations imposed on the amputee and their effect on exercise, the following areas will be discussed:

1. Need for physical exercise among amputees.
2. Areas of limitation.
3. Factors in extra-ambulatory prosthetic design.

Need for Physical Exercise

The level of physical activity a person attains naturally affects his quality of life. This motivates a general public concern for physical fitness. The physically handicapped are no exception. In fact, to the younger, more aggressive amputee, the level of physical activity he is able to exert is critical. Today, despite this need for physical exercise, figures show that most amputees become limited in their ability to participate in physical exercise programs.[1] This disability seems greatest for the amputee who was active prior to amputation. Whether the patient was active prior to amputation or not, the end result is the same—inactivity. As one patient put it, "There are those of us in whom the spirit of physical exertion becomes tarnished . . . it no longer becomes important to be so active. The effort is too much."

While it is natural to decrease one's level of activity after amputation, some serious questions remain. Are the members of the rehabilitation team doing all they can to maximize the patient's level of activity? if everything is being done for amputees, why do so many continue to be physically inactive? Why do so many lose their ability to participate in physical exercise and lack the basic skills for sports activities despite the need for such physical outlets?

Most patients lose their ability to participate in physical exercise programs not only as a result of amputation, but also, and perhaps more importantly, as a result of poor post operative care.

Areas of Limitation

There are many reasons why amputees are inactive, perhaps as many reasons as there are amputees. Age, level of amputation, and general physical condition of the patient are usually considered the primary reasons why amputees are limited. But the reason amputees are inactive, in the majority of cases, is not due to a physical cause, but to a lack of information. Not many people, including the rehabilitation team, know about extra-ambulatory activities.

To illustrate this, examine the current level of rehabilitation. Presently, rehabilitation focuses most of its attention on a basic activity (walking), and once this minimal level of activity is achieved, assistance is usually discontinued. This in effect limits the patient's functional capabilities and discourages patient participation in physical activities.

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Stating that an amputee cannot participate in extra-ambulatory activities without knowing of the possibility is like asking someone a question in French without his knowing the language, and then saying "Look, I told you he didn't know the answer." A person needs to know how to do something or have knowledge about something before he can be expected to do it. The problem then, is not lack of ability, but lack of knowledge. If it is our purpose to increase the amputee's level of activity, a considerable amount of attention needs to be directed toward extra-ambulatory activities and the communication of this information.

A recent survey on functional capabilities[2] discovered that of those amputees questioned, 60% currently participate in some form of sporting activity, indicating a definite desire on behalf of the patients to participate in physical activities.

The most common activities (Table 1) are swimming and fishing, and the least common, due to discomfort, are running and walking long distances. During running, a substantial amount of irritation occurs because of the impact and the rotational forces within the prosthesis, which cause tissue irritation. Despite this irritation, however, amputees continue to run because running is a prerequisite for many other physical activities. The most active patients are young individuals whose amputation resulted from either congenital deformity or trauma. Sex and length of time since amputation have little effect on the patient's ability to exercise, while age and level of amputation play a definite role in determining functional ability.[2] Other factors, including pain, social embarrassment, and lack of organized training programs, must also be considered.

When asked about their prosthetist, 28% of the patients in the recent survey felt that their prosthetist knew about extra-ambulatory prostheses. However, of the prosthetists sampled, only 18% encouraged participation, indicating a high reluctance on the part of prosthetists. The reasons for this reluctance is not so much physical make-up, but, as stated earlier, lack of information. When making a prosthesis for extra-ambulatory activities, the prosthetist needs to have knowledge about the activity and must be able to design the prosthesis around the activity. Designing an extra-ambulatory prosthesis isn't easy. It often involves the incorporation of different materials and principals—a time consuming process. As one patient quoted his prosthetist when he was asked about extra-ambulatory prostheses, "'It is too much work and too much adjustment.'" Perhaps a reason why the level of physical activity is so low among amputees is the prosthetist's inability or unwillingness to design a prosthesis for extra-ambulatory activities.

Despite the reluctance on behalf of the prosthetist, 6% of the patients sampled used special equipment for sporting activities while the remaining 94% either indicated a willingness to make do with their current prosthesis or were unaware of adaptive devices available to them.

When informed about the existence of these devices, a majority asked why they had never been told about these prostheses before, indicating a need for additional information in the areas of prosthetic design, training programs, and support organizations.

To make a patient more comfortable with his individual situation, he can often be directed toward meeting other amputees. Through this social interaction the patient can find support by sharing similiar situations with other amputees and by finding he is not alone in confronting the problems associated with amputation. Often it is this kind of support that can make the difference between the patient being successful or unsuccessful in obtaining his maximum potential. (For a list of organizations serving physically disabled persons interested in sports and recreation, see p. 7).

Prosthetic Design

Advances in prosthetics are based on two things: 1) patients' need for improved function, and 2) technical knowledge. Based on this need for improved function, advances in prosthetic components and systems will continue to be developed. Recently, with an increase in extra-ambulatory activities, prosthetists have begun to realize the need for extra-ambulatory prostheses. Some prosthetic innovations already exist,[3] but additional research is needed in this area.

The most common activities requiring prosthetic modification are swimming, running, and skiing. Since each one of these activities is different, the prosthetist must design the prosthesis specifically for that activity.

Swimming

Of primary importance for a swimming prosthesis are: 1) its ability to hold up under water, and 2) its ability to float. A swimming prosthesis must be made out of waterproof materials. If not, special attention must be taken to seal any material that can absorb

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Table 1: Avocational Activities

	Below Knee	Above Knee	Bilateral	Total
Fishing	46	11	5	62
Swimming	29	11	4	44
Dancing	28	8	5	41
Hunting	19	4	1	24
Bowling	15	5	—	20
Golfing	15	5	—	20
Hiking	11	3	1	15
Baseball	9	3	2	14
Basketball	7	3	1	11
Running	6	2	1	9
Snowskiing	4	3	—	7
Football	4	2	1	7
Skating	4	1	1	6
Horseback riding	—	3	1	4
Gardening	3	—	1	4
Miscellaneous*	6	6	1	13

*Miscellaneous includes waterskiing, motorcycling, soccer, flying a sailplane, frisbee, cutting wood, cheerleading, boating, pingpong, and uneven parallel bars.

water such as wood or leather. When wood becomes wet, it swells and causes delamination.

Regarding the question of buoyancy, the prosthesis must be able to float, yet give little resistance to immersion. If the prosthesis is too buoyant, the patient is unable to submerge the device while swimming, which can cause the prosthesis rather than the patient's head to be above the water. To solve this problem, some prosthetists have designed prostheses that fill with water, which solves the buoyancy problem associated with the use of foams. The only problem with this design is that the water also needs to drain out fairly rapidly and if it doesn't, the prosthesis will remain full of water or leave a trail of water in its path.

Running

As stated earlier, running is a prerequisite for most sports activities. Due to the rotational and impact forces on the residual limb during running, a considerable amount of attention is needed in this area. Of particular importance in the design of such a prosthesis is suspension. The prosthesis must be suspended securely so as to eliminate all or as much pistoning as possible. To do this, the prosthetist can incorporate a rubber suspension sleeve or a thigh lacer with waist belt. The thigh lacer aids in medial/lateral stability, and also decreases the rotational forces on the residual limb. Therefore, if the patient is extremely active, whether he has a short residual limb or not, it is recommended that a thigh lacer be used.

As well as tackling the problem of suspension, the prosthetist also needs to consider the matter of interface/liner materials. The liner must be able to decrease the rotational forces inside the socket so as to eliminate friction. Conventional Kemblo®, leather, and Pelite® liners have been used in the past with little success. If the patient is extremely active or has residual limb problems caused by excess rotation, a silicone or sorbathane insert should be used. To further minimize the rotation inside the socket, the prosthetist can incorporate a rotator in the prosthesis. A Greissinger foot can be used to decrease rotational capabilities, and is strongly suggested for those patients engaged in physical activities.

Skiing

Various types of skiing prostheses have been made. Their designs have ranged from incorporating the prosthesis directly into the ski boot, to modifying the patient's existing prosthesis. What is of primary importance in either case is that one maximizes the patient's knee flexion and aligns the prosthesis so the patient's center of gravity lies in front of the ski boot. This is the section of the ski that initiates the turn and if one does not align the prosthesis so that the patient's weight is over the front of the ski, turning will be difficult.

Depending on the patient's level of activity, knee stability and length of residual limb, the incorporation of a thigh lacer into a ski prosthesis may or may not be needed. A turn on skis is initiated by a varus or valgus movement of the knee. If the prosthetist incorporates a thigh lacer into a ski prosthesis, he is in effect limiting knee motion and making the ski harder to turn. Therefore, if the patient can do without a thigh lacer, let him do so, because it gives him more maneuverability.

Before designing a prosthesis for a specific activity, it is critical that the prosthetist look at the functional ability of the patient and the specific activity, and then design a prosthesis around that activity. It is only through this process that the prosthetist can develop a prosthesis that satisfies the patient's individual needs. Ultimately it is the patient's individual needs that dictate prosthetic design.

Conclusion

Despite the limited amount of technical information available on extra-ambulatory activities, they have received a considerable amount of public attention. That attention must now be directed toward decreasing the physical limitations imposed on amputees. This can only be achieved through an increase in patient/team rehabilitation communication, improved prosthetic design, and direct therapy programs. It is only by such means that amputees can experience their true physical potential.

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Questionnaire

Send completed forms to Charles H. Pritham, CPO, Durr-Fillauer Medical, Inc., Orthopedic Division, 2710 Amnicola Highway, Chattanooga, Tennessee 37406.

1. How many extra-ambulatory prostheses have you made?
   A. 0–5
   B. 6–15
   C. 16–25
   D. 26–50
   E. Greater than 50

2. What percent of your patients are involved in some form of physical exercise?
   _____ %

3. What percent of your patients ask you about extra-ambulatory prosthetics?
   _____ %

4. List the patients' activities in order of occurrence.
   1. _____ 4. _____
   2. _____ 5. _____
   3. _____

5. What percent of your patients use their prosthesis for a dual purpose—for extra-ambulatory activities and daily activities?
   _____ %

6. What percent of your patients have one prosthesis for daily activities and one for extra-ambulatory activities?
   _____ %

7. Do you inform your patients about handicapped sports organizations?
   _____ Yes _____ No

8. Are you satisfied with the level of prosthetics and its role in extra-ambulatory activities?
   _____ Yes _____ No

9. What do you feel is the primary reason(s) for amputees not becoming more involved in sports activities?

10. Would you be interested in attending a seminar devoted to the topics of sports activities for amputees and extra-ambulatory prostheses?
    _____ Yes _____ No

11. Do you have any suggestions or comments that might improve the level of care for the amputee concerning extra-ambulatory activities?