

A Clarion to Recommit and Reaffirm Burn Rehabilitation

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Burn rehabilitation has been a part of burn care and treatment for many years. Yet, despite of its longevity, the rehabilitation outcome of patients with severe burns is less than optimal and appears to have leveled off. Patient survival from burn injury is at an all-time high. Burn rehabilitation must progress to the point where physical outcomes parallel survival statistics in terms of improved patient well-being. This position article is a treatise on burn rehabilitation and the state of burn rehabilitation patient outcomes. It describes burn rehabilitation interventions in brief and why a need is felt to bring this issue to the forefront. The article discusses areas for change and the challenges facing burn rehabilitation. Finally, the relegation and acceptance of this responsibility are addressed. (J Burn Care Res 2008;29:425–432)

Burn rehabilitation has been a part of the burn team concept ever since a formalized approach to interdisciplinary patient treatment was implemented 40 years ago. To write a discussion centered on the role or place of rehabilitation in the recovery of patients with burns might at first seem absurd. However, patients entrusted to our collective care need to advance in their physical recovery beyond that which we currently provide them. The purpose of this position article is to present and discuss an apparent lack of substantial progress made in burn rehabilitation dur-

ing the past four decades and to call for a genuine recommitment and reaffirmation to this vital patient care service. Furthermore, this writing is to heighten the awareness of burn team members as to the need for burn rehabilitation advancements rather than to prescribe answers to the described situation. Every burn center functions within its own unique environment and each burn center only can individually decide how best to alter its own process, if a need for such change exists.

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Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE 01 MAY 2008	2. REPORT TYPE N/A	3. DATES COVERED -	
4. TITLE AND SUBTITLE A clarion to recommit and reaffirm burn rehabilitation		5a. CONTRACT NUMBER	
		5b. GRANT NUMBER	
		5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Richard R. L., Hedman T. L., Quick C. D., Barillo D. J., Cancio L. C., Renz E. M., Chapman T. T., Dewey W. S., Dougherty M. E., Esselman P. C., Forbes-Duchart L., Franzen B. J., Hunter H., Kowalske K., Moore M. L., Nakamura D. Y., Nedelec B., Niszcak J., Parry I., Serghiou M., Ward R. S., Holcomb J. B., Wolf S. E.,		5d. PROJECT NUMBER	
		5e. TASK NUMBER	
		5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) United States Army Institute of Surgical Research, JBSA Fort Sam Houston, TX 78234		8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)	
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited			
13. SUPPLEMENTARY NOTES			
14. ABSTRACT			
15. SUBJECT TERMS			
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	UU
			18. NUMBER OF PAGES 8
			19a. NAME OF RESPONSIBLE PERSON

Chronicle of Burn Rehabilitation Intervention

Severe burn injury presumably has plagued the human race since Peking man first began using fire for purposeful reasons one-half million years ago.¹ Face-tiously, it is not unlikely that the first damaging injury experienced by this Homo genus was a hand burn resulting from fire used for cooking. Since that time, defined rehabilitation treatments evolved and can be traced back to the 1600s for splinting and through the 1800s for other interventions of pressure and exercise.²⁻⁴ However, the timely initiation of these treatments differed greatly compared with today's standards.⁵ Before 1958, a delay in the initiation of burn rehabilitation until long after the injury was common.⁶ Coincidentally, in that same year, Dr John Moncrief wrote two seminal articles that propelled the implementation of rehabilitation treatments to the forefront. He advocated a reduction in time for the initiation of burn rehabilitation from weeks and months following injury to the time of patient admission to the hospital, as well as decreasing the delay for reimplementation of rehabilitation treatments after surgical procedures.^{7,8} Shortly thereafter in 1967, the burn team construct as we know it today was introduced by the formation of the American Burn Association (ABA) and burn therapists were included as integral team members.⁹ Hence formal burn rehabilitation as a discipline involved in the treatment of burn injured patients has been organized for only a relative short period of time.

The ABA, as depicted on the original emblem of the Association, was founded on four tenets: care, teaching, research, and prevention. In 1992, then ABA President, Dr Roger Salisbury, sponsored the pentagonal addition of "Rehabilitation" to the ABA logo. In his presidential address to the ABA membership that year, Dr Salisbury revealed many shortfalls in providing patients with a program of comprehensive burn rehabilitation.¹⁰ About the same time and continuing into the present, patient outcome studies have received increased emphasis as a compliment to patient survival statistics.¹¹ In 1994, the National Institute on Disability and Rehabilitation Research funded the Burn Model Systems (BMS) project initiative designed to collect data related to the acute management and long-term rehabilitation outcomes of seriously burned patients.¹² The BMS has assembled large volumes of demographic and epidemiologic information for both adults and children, publishing no less than 97 journal articles.¹³ The vast majority of these articles (41%) focus on psychosocial and pain-related issues and 38% of the titles surround basic science and acute burn care topics. A mere 8%

are directly related to physical rehabilitation whereas another 6% document physical outcomes. The remaining publications present descriptive (3%), review (3%), and prevention (1%) information.

Current Demand for Burn Rehabilitation

To afford patients with severe burns an optimal opportunity for full recovery, more funded research and administrative support must be directed to discerning prototypical rehabilitation processes (Table 1). Although the BMS and other outcome studies have been important to establish a baseline for comparison, the real challenge in burn rehabilitation was ex-horted by Dr. Glenn Warden in his 1993 ABA presidential address when he stated: "We must do more than just study the problems of rehabilitation. We must *do* something about it (his italic)."¹⁴ Fourteen years later, that clarion still holds true prompting a lingering fundamental question: when is burn rehabilitation going to advance the physical outcome of burn survivors?

Throughout the development and formalization of burn care, patient mortality from severe burns has decreased dramatically.¹⁵ Patients are surviving more severe burns to the extent that survival is no longer considered a primary end point of care.¹⁶ Accordingly, with patients surviving greater total body surface area (TBSA) burns, there is a concomitant increased potential for the appearance of scar tissue contractures as normally pliable skin is replaced by inelastic burn scar. In 1988, Kraemer et al reported a direct relationship between mean burn size and the number of resultant scar contractures experienced by patients.¹⁷ These results recently were corroborated by Leblebici et al, but with a worse slope of regression indicating poorer clinical outcomes.¹⁸ In other words, patients of similar burn size are experiencing more contractures. Of note, it is interesting that in both of the two foregoing articles, burn scar contractures went unreported in patients with less than 22 to 25% TBSA burn. At this point it is unclear whether scar contractures at this percent TBSA fail to occur or are prevented through proper rehabilitation.

Regardless, the prevention of burn scar contracture has not kept pace with the rate of patient survival. In

Table 1. Research needs for improved burn rehabilitation outcomes

Funding to support clinical research
Protected time to perform research
Organized collaborative networks
Rehabilitation data set repository

fact, the incidence of scar contracture seems to be worsening. In 1972, Dobbs and Curreri documented in a case series of 681 patients that 28% of patients had developed burn scar contractures.¹⁹ In 1988, Sheffield et al reported a similar 25% incidence of contracture in a population of 143 patients.²⁰ More recently, scar contracture incidences of 50, 42, and 39%, respectively have been documented.^{18,21,22} Neither Dobbs and Curreri¹⁹ nor Kowalske et al²¹ stated an average percent TBSA in their study groups but rather reported contracture incidence based on percent TBSA ranges and associated age. In the articles by Sheffield et al,²⁰ Schneider et al,²² and Leblebici et al,¹⁸ the respective group mean TBSA burn were 10, 25, and 27%. The latter two articles report TBSA burns greater than the current national average.²³ Accordingly, one could surmise that such outcomes are simply attributable to patients surviving larger burns and thereby they have an increased probability to develop scar contracture. However, acquiescing to this reasoning only contributes to patronizing the service that burn rehabilitation should be providing and reflects the attitude of years past when scar contracture was accepted as an inevitable outcome of being burned.²⁴

Perspective on Burn Rehabilitation Challenges

One challenge facing the burn rehabilitation community therefore is to modify the linear association of TBSA with burn scar contracture development by reducing the incidence and severity of contracture to mirror the medical model of improved patient survival. The techniques currently used to treat scar tissue essentially have remained unchanged for centuries. Perhaps the time has arrived to look beyond conventional practice for new ideas about burn rehabilitation. The other longstanding scar manifestation is the issue of hypertrophy and how best to prevent or treat it. The number of articles that address this clinical problem are too numerous to list and often lack the scope needed to define a standard of care. Suffice it to state that: the origin of scar hypertrophy and keloid formation is some form of yet undefined cellular or biochemical aberration; the precise cause and optimal treatment of scar overgrowth remains elusive; and the prediction of Heimbach in his 1988 ABA presidential address has proven true almost 20 years later in that only “small steps in preventing hypertrophic scars have been made” to date.¹⁶

To cultivate change in the realm of burn rehabilitation, an alteration in the mind set of service delivery must occur. In the formative years of burn team care, rehabilitation experienced an immediate integration with the formation of the ABA. Burn rehabilitation, if

viewed as a new commodity available on the open market, experienced an initial sharp rise in acceptance as part of a product life cycle. Subsequently, the output of physical rehabilitation has become negatively skewed, having yet to either define or meet product expectations. Fortunately, interest in the burn rehabilitation as a product line has remained high. However, burn rehabilitation has become stagnant in a mode as an appurtenant of patient care in many institutions. For example, a physician (whose name and institution will remain anonymous) recently referred to “therapy (rehabilitation) as a secondary resource” in a formal platform presentation at a 2006 regional burn seminar. The mind set of service delivery must include early and intense rehabilitation.

In the literature, “phases” of burn care have been described where, in many instances, the “rehabilitation phase” is synonymously associated with beginning at the time of wound closure²⁵; or thereafter, when “reparative plastic surgery is performed during the rehabilitation stage.”²⁶ Although rehabilitation interventions are acknowledged as being of lesser priority than medical treatment during the emergent phase of patient care, rehabilitation has a service to provide that can be performed safely at this time.^{27–30} In the long term, rehabilitation treatment surpasses other forms of care in terms of quantity and duration. Notwithstanding, long-term outcomes of burn patients begin to be established long before the wound closes. Immediate edema formation that interferes with range of motion and patients functional capacity needs to be treated and reversed expeditiously. Within the microcellular environment of the proliferative stage of healing, the components of ultimate burn scar contracture are developing; in as much, early intervention is documented to influence collagen fiber orientation which is a key factor in burn scar development.^{31,32}

Therefore, rehabilitation must be regarded as a continuum of care with changing points of emphasis rather than an isolated phase. As of this writing, a new schema of burn rehabilitation phases is proposed as seen in Figure 1. The early rehabilitation phase is defined as beginning at the time of patient admission and continuing until about the time that a patient’s wounds are 50% closed or skin grafting for wound closure has begun. The intermediate phase is that time surrounding closure of the wound and extending up until the time of complete wound closure. The long-term phase occupies the timeframe from wound closure or discharge from the acute hospital setting until such time that a patient has received maximal benefit from rehabilitation services including reconstructive surgery. Obviously, the early and long-term

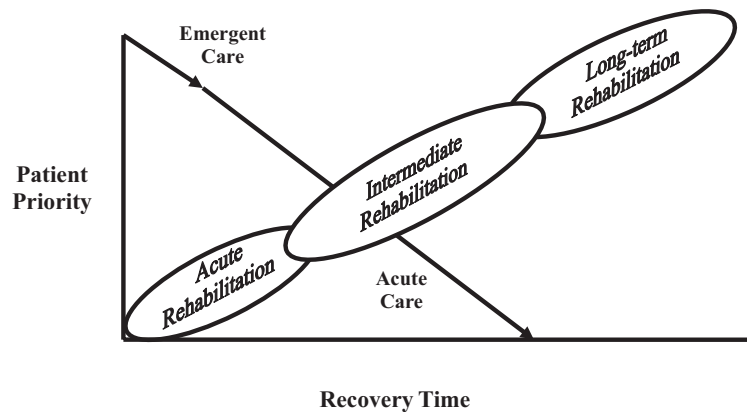


Figure 1. New proposed timeline and descriptive schema for burn rehabilitation.

phases can overlap with the extremes of the intermediate phase depending on the healing progress of various wounds of each patient.

Constructing a Direction for Burn Rehabilitation

A major portion of the responsibility for a projected lack of rehabilitation value is the paucity of definitive and practice changing research that has been reported. A recent comprehensive and excellent examination of burn rehabilitation literature revealed that of 244 articles covering 22 rehabilitation-related topics, only 9% contained level I and II research evidence whereas 91% contained level III and IV information.³³ A prime example of this problem surrounds mouth splints used in rehabilitation. No less than 56 different types of mouth splints alone to treat perioral burns have been described^{34,35}; however, there has yet to be a clinical comparison between any two mouth splints in regards to efficacy of one version over another. For the sake of our patients, we must move beyond simple ingenious thoughts and devote more effort to substantive investigation. Because of the low incidence of extensive burns, multicenter trials in rehabilitation will be necessary to generate sufficient patient volume to uncover optimal practice interventions.

As previously highlighted, National Institute on Disability and Rehabilitation Research has contributed substantially to the overall publication pool for burn rehabilitation. Nonetheless a greater emphasis must be placed on physical rehabilitation processes that produce best practices to improve patient outcomes. This goal can be achieved through increased rehabilitation staffing and by more active solicitation of requests for proposals and thorough follow-up on research questions that demand answers. The ABA also could assist in this process by adding pertinent

rehabilitation items to the dataset collected as part of the National Burn Repository.²³

The burn rehabilitation community certainly benefits from pockets of support. The current *Journal of Burn Care and Research* has continued to embrace and welcome the publication of rehabilitative efforts with dedicated sections carved out for rehabilitation in general and occupational and physical therapy in particular. Burn therapists, specifically and collectively, as lead authors have contributed a total of 215 articles to *Journal of Burn Care and Research* during the years as seen in Figure 2. The ABA provides opportunity for learning and interchange among the many and varied activities offered at the annual meeting. Special Interest Groups for therapist participation include a specific Occupational Therapist/Physical Therapist Special Interest Group. Similarly, therapists can be a part of multiple committees including one devoted specifically to rehabilitation. Additionally, there are opportunities for platform and poster presentations (Figure 3). This type of support is seen on a regional basis as well with the Southern Region Burn Conference.³⁶ In addition, ABA requirements for burn center verification include eight required criteria related to rehabilitation personnel, four of which center on education and mentorship.³⁷ Although support exists, more opportunities must be developed, such as protected time for therapist research and focused continuing education specifically dedicated to promote burn rehabilitation progress (Table 2).

It logically is befitting that rehabilitation is a part of the Guidelines for the Operation of Burn Centers.³⁷ However, an interesting question is, how many failed rehabilitation criteria would be required for a burn center to fail the verification process in light of the current discussion on the importance of burn rehabilitation. To further this point, it would be interest-

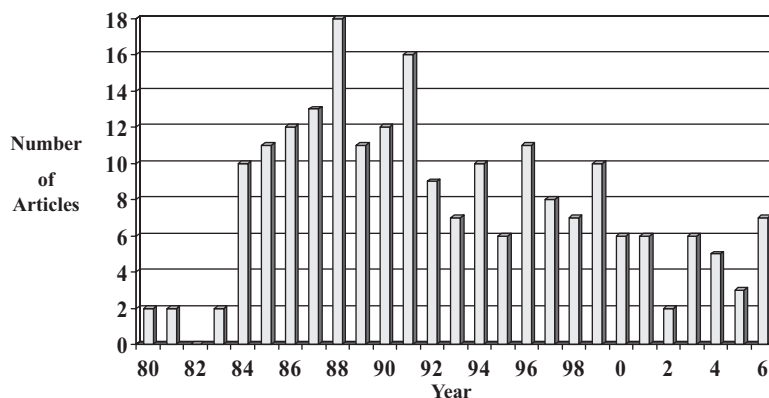


Figure 2. Number of articles by year published by rehabilitation therapists as lead author in the *Journal of Burn Care and Rehabilitation/Research*.

ing to ascertain at how many required patient mortality and morbidity conferences physical sequelae, such as the presence of pathologic burn scar contracture, scar hypertrophy, heterotopic ossification, or neuropathy, are discussed. Similarly, but along a different vein, it would be intriguing to know if, when a physical medicine intervention such as applying a burn splint is overlooked, whether this oversight gets reported as a critical incident similar as to when a patient misses a dose of medication. The burn team must hold themselves accountable for these all important considerations.

Not all efforts in burn rehabilitation during the past three decades have been fruitless. Huang et al documented that the use of burn splints decreased the incidence of scar contractures.³⁸ However, beyond mouth splints already mentioned, there are at least an additional 81 burn splints that have been described in the English language literature to treat 13 other body

areas without a comparative study demonstrating effectiveness.³⁹ Additionally, clinical questions about both the timing of splint application and location of splint use related to burn depth remain unanswered.⁴⁰⁻⁴³ A cogent example of improved burn patient outcomes was reported by the staff from the Boston Shriners Burns Institute where a series of 10 pediatric patients with $\leq 30\%$ TBSA were found to have no functional deficits at 12 months following burn injury.⁴⁴ However, the mean TBSA burn of these children was 11% and no range, median, or mode of burn extent was provided. Leblebici et al includes four patients with burns between 30 and 40% TBSA that were without contracture at 21 months after injury.¹⁸ Another example was most recently documented by Whitehead and Serghiou in a comparative survey regarding a change in practice, especially as it related to earlier ambulation following skin grafting, compared with 12 years ago.⁴⁵ For burn

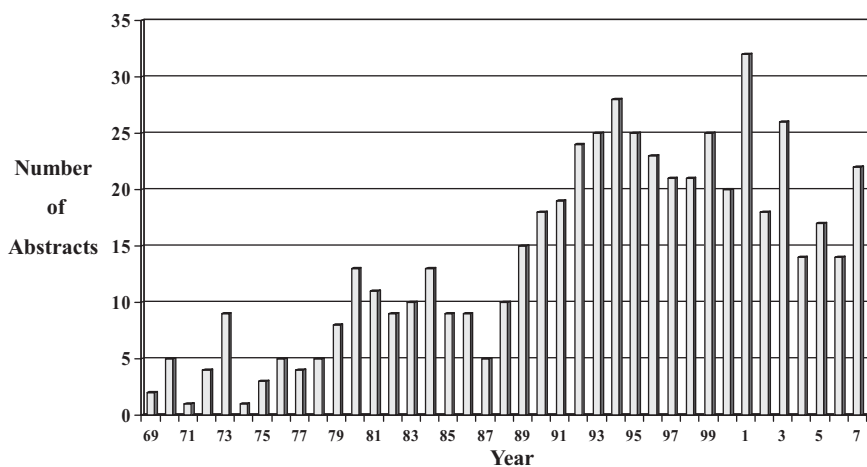


Figure 3. Number of abstracts by year presented by rehabilitation therapists as lead authors at the annual meetings of the American Burn Association.

Table 2. Personnel needs for improved burn rehabilitation outcomes

Sponsored educational opportunities
Additional educational opportunities
Increased and dedicated rehabilitation staff
Therapist accountability for increased support

rehabilitation to demonstrate progress, it is incumbent for like outcomes to be documented routinely rather than by exception. Furthermore, these types of outcomes must be documented in a shorter period of time. From here, prospective research must be performed to significantly improve patient outcomes.

One hypothesis as to why there seems to be an apparent lack of rehabilitation progress focuses on the availability, as well as longevity, of therapists in the field of burn rehabilitation. Most recent figures from the ABA indicate that burn therapist membership increased 13% during the past year to a total of 215 burn therapist members (Figure 4). This number represents only 8% of the total ABA membership. Assuming clinical experience in burn rehabilitation is mirrored by years of membership in the ABA, 52.3% of burn therapists have 5 years or less of experience. This figure is compared with 51.5% of physicians who have been ABA members for 13 years. Furthermore, the calculated total years of combined experience for physicians in burn care totals 11,849 years vs 1759 for therapists. There is a recognized shortage of burn care personnel and experienced therapists are no less in a deficit.^{46,47} The need for experienced rehabilitation

personnel has never been greater and must receive the necessary support to be rectified.

The process of rehabilitating a person after a severe burn equates to an endurance event. According to Dr. Salisbury, “Although everyone claims to be interested in rehabilitation, a recent survey of burn facilities conducted by the Committee of Organization and Delivery of Burn Care of the ABA revealed a shocking lack of personnel, sophistication, and time commitment for rehabilitating survivors.”⁴⁸ Unfortunately, this comment was written 20 years ago. Support for burn therapist recruitment and retention as well as time to perform desperately needed research is paramount if we are to advance the outcome of burn survivors (Table 2).

Relegation of Responsibility for Progress

Oftentimes, changes as discussed are a matter of personnel and finances. Rehabilitation services traditionally have been revenue producers for health care facilities with income generated over expenses. Depending on the census activity of any given burn center, burn therapists generally can more than cover what it costs for them to be an employee. The situation then becomes an administrative issue as to allocation of therapist time and a commitment to support burn therapist research. As an example, a therapist could partition the day into clinical time to insure productivity to support the position, and dedicate the remaining time to research initiatives. This situation would require a commitment from the burn center and hospital leadership to supplement this agreement

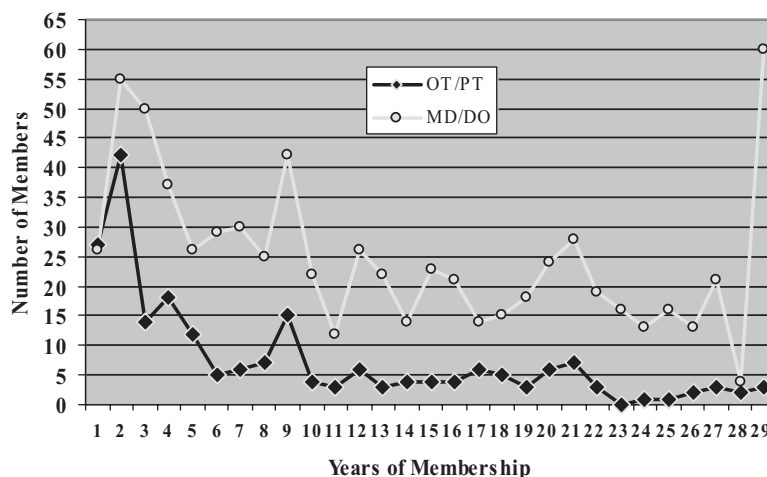


Figure 4. Rehabilitation therapist and physician comparison of years of membership in the American Burn Association. The number of physician members with 29 years experience is actually 125. It is indicated as 60 members for graph proportionality reasons. Eleven physicians actually have more than 29 years membership in the ABA, which is included in the calculation of total membership years as reported in the manuscript. Source: American Burn Association Central Office, Chicago, IL.

with additional staff to provide the remaining clinical care.

A more progressive and the more ideal alternative arrangement is for the burn center leadership and hospital administration to jointly agree to emphasize burn rehabilitation research as a required priority of care and create funding for the position without regard to fiscal issues. For success, the burn center director must advocate to implement this change and therapists must demonstrate responsibility over the position by producing substantial burn rehabilitation research.

During the past 30 years, because improved survival rates became a common discussion, there exists at least one manuscript in each of the last six quinquennia which makes mention to the effect that “the emphasis of burn care needs to shift from patient survival to rehabilitation”.^{49–54} As we approach 40 years of ABA existence, burn rehabilitation appears to have retained its importance but has yet to fully attain its significance. The foregoing perspective is intended only to stimulate and energize burn team members by way of a reengineered perspective on the subject of burn rehabilitation initiatives vs to minimize the substantial effort that rehabilitation providers have afforded patients to date.

CONCLUSION

As advances in clinical care have resulted in marked improvement in survival, the view of outcomes used to measure long-term success in burn rehabilitation must be changed. Treatment plans and interventions must emphasize restoring patients’ preburn functional status while maximizing their emotional and cosmetic outcomes. The goal of burn care must shift from patient survival as an end state to a state of restored living through focused rehabilitation and research initiatives. To accomplish this task, there must be a sincere reaffirmation to support and advance the development of the burn rehabilitation process. A substantive recommitment, both administratively and clinically, must support future improvements and advancements in burn rehabilitation, so patients can thrive beyond survive.

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