

Effects of Oncology Rehabilitation for Head and Neck Cancer- a Review

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Pre-Physical Therapy

To
The Honors College
Oakland University

In partial fulfillment of the
requirement to graduate from
The Honors College

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(3/1/13)

Effects of Oncology Rehabilitation HNC

Abstract

Purpose: Head and neck cancer (HNC) affects three to five percent of Americans. Few studies have focused on the effect of rehabilitation exercise on the common symptoms of head and neck cancer. Hence, the purpose of this literature review was to study current research regarding the effects of physical therapy implemented exercise. **Method:** An extensive literature search was conducted using search engines: Google scholar, PubMed, Chinhal Plus, Cochrane library, Medline and Library OneSearch. **Search results:** 26 sources including studies and reviews were included based on their relevance to rehabilitation exercise and head and neck cancer survivors. **Conclusion:** Rehabilitation exercise has been shown to have positive outcomes of quality of life in head and neck cancer survivors. Most evidence in existence is preliminary trials regarding fatigue, oral health, lymphedema, and shoulder dysfunction. A high adherence and feasibility rates for rehabilitation exercise has been found in head and neck cancer patients despite high morbidity of oncology treatment. More research on the effects of rehabilitation exercise is needed to validate the effectiveness of interventions shown in the current research available.

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Introduction

Head and neck cancer affects three to five percent of Americans. Head and neck cancers (HNC) are defined as cancer that arises in the head or neck region including the nasal cavity, sinuses, lips, mouth, salivary glands, throat, or larynx. Most of head and neck cancers start in the cells that line the mucosal surfaces ("Head and Neck Cancer"). This grouping of cancers can also originate in gland cells and are considered adenocarcinomas. This year, an estimated 52,140 people (37,870 men and 14,270 women) will develop head and neck cancer, and an estimated 11,460 deaths (8,300 men and 3,160 women) will occur (American Society of Clinical Oncology). Although not as common as other publicized cancer groups, head and neck oncology Rehabilitation for head and neck cancer is a growing field with limited research regarding its effectiveness.

Post-operative rehabilitation has not been standard of practice in the current management of patients following neck dissection. Referral to physical therapy is often made after issues start to affect quality of life including sleeping and other ADLs. Patients may receive physical therapy to improve movement and decreased neck motion function, and to regain skills, such as talking and swallowing. Following surgery for cancer of the oral cavity, pharynx (throat) or other parts of the head and neck region, comprehensive rehabilitation is critical (Fox Chase). Oncology rehabilitation is a growing field as pilot studies and more research are being developed and published.

Living after head and neck neoplasm diagnosis and treatment is both mentally and physically draining on a patient. Like many cancer patients, there is a loss of control over their bodies and lives. Common side effects of treatments for head and neck cancer vary slightly by specific treatment. Side effects of surgery include temporary or permanent

loss of normal voice, difficulty chewing and swallowing, hearing loss, swelling of neck and face, and breathing impairments. Side effects of radiation include irritation, swelling, bone pain, fatigue, difficulty swallowing, and fluid buildup in ear that affects equilibrium (American Society of Clinical Oncology). Improving the quality of life of head and neck cancer patients is a major goal in oncology rehabilitation.

In an article review done by Lauchlan, McCaul, and McCarron, it has been shown in multiple studies collected that post-operative rehabilitation can be effective in reducing disability in the shoulder after a neck dissection. Numerous studies done by McNeely, Parliament, Seikaly, Jha, Magee, Haykowsky, and Courneya showed the responsiveness of patients to post-operative rehabilitation. The side effects common to radiation and chemotherapy include cancer related fatigue, numbness of face and neck, neuropathy of hands and feet, cardiovascular dysfunction, and pain in the face, neck and shoulder. Physical rehabilitation after cancer treatment allows for increases in health and vitality among survivors. Research regarding the effectiveness of rehabilitation interventions has increased in importance within the last ten years and continues to increase with more velocity. This literature review examined the current research available as well as discusses the relevance that these studies are providing the trajectory of future research.

Method

An extensive literature search was conducted using search engines: Google scholar, PubMed, Chinal Plus, Cochrane library, Medline and Library OneSearch. The keywords that were used to search the articles were “head oncology”, “neck oncology”, “physical therapy”, “rehabilitation”, “neoplasm”, “intervention”, “quality of life”,

“physical activity” etc. The terms “and” or “or” were used accordingly. Manual searches of the reference lists from the retrieved articles also were performed. Only articles from the last 10 years were used.

Search Results

Article search revealed the list of studies that have focused on rehabilitation exercise and its effects on the various side effects due to head and neck oncology intervention. Oncology rehabilitation is a holistic approach and therefore multiple aspects of life will be considered. For the convenience, the articles were divided mainly into four groups 1) Rehabilitation exercise and Quality of life 2) Rehabilitation exercise and Lymphedema 3) Rehabilitation exercise and shoulder dysfunction, and 4) Adherence and Compliance of Rehabilitation exercise. Rehabilitation exercise and Quality of life will be further divided in 1) Fatigue and 2) Oral health.

Head and Neck Oncology Rehabilitation: Current State and Barriers

The term “rehabilitation” refers to a process aimed at enabling persons with disabilities to achieve and maintain their optimal physical, sensory, intellectual, psychiatric, and/or social functional levels, thus providing them with the tools to adapt their lives toward a higher level of independence (WHO). This review deals with the maintaining the optimal physical levels due to evidence based treatment as well as maintenance of the other levels mentioned due to physical rehabilitation. There are several forms of rehabilitation and this review concentrates with restorative rehabilitation after oncology interventions including surgery. The review showed a lack of research focused on preventative rehabilitation, where no significant physical impairment exists

but therapy is started to prevent functional loss. Cancer rehabilitation is an important stage of cancer survivorship that has not been emphasized.

The lack of emphasize on the important of rehabilitation for those living with their cancer has created barriers in the current state of interventions. Silver and Gilchrist established that the most predominate barrier is the lack of training in oncology rehabilitation of rehabilitation providers (Silver and Gilchrist). This is problematic because effective procedures are not being administered to patients due to lack of universal therapist knowledge when treating head and neck cancer patients. This is partly due to the lack of research of effectiveness as well as post operation rehabilitation has not been a standard of practice until symptoms arise. Referral to physical therapy is often made after issues start to affect quality of life including sleeping and other ADLs.

Another barrier is the lack of communication and relationship between oncology physicians and rehabilitation providers (Silver and Gilchrist). A lack of interaction between two medical professionals regarding patients can lead to challenges when providing appropriate care. As treatments for cancers evolve with technology increases, the prognosis of cancers also increase. This will only continue in the future until a cure is found. Effective and cost efficient rehabilitation must also evolve with the fast paced nature of the oncology. Communication between physicians and rehabilitation health providers is crucial to providing better health care to patients. The small amount of research dictates that there is room for improvement regarding education and awareness of the importance of rehabilitation for head and neck cancers. Research on effective interventions is only useful if it is being implemented into a standard of practice for cancer survivors. The current state of head and neck cancer oncology rehabilitation is

moving forward as research advances but there is much more than can be done in the future.

Rehabilitation and Quality of Life

Quality of life is a term often utilized in research regarding cancer survivorship. Cancer is not a universally equal opportunity disease. Patients diagnosed with head and neck cancers range in age, gender, race, and socioeconomically status. Each case is specific based on the patient and the goal of rehabilitation is to increase a specific patient's quality of life. Quality of life (QOL) evaluation addresses patient outcomes holistically and also includes physical, emotional and social components associated with illness. QOL assessments are usually subjective quantifiable outcomes, which are reported by the patient (*Balasundaram et al.*). The studies included in this review note that quality of life measures for head and neck cancer are subjective to the patient and site specific. Among head and neck cancer patients, fatigue and depression are prevalent.

Fatigue

Fatigue occurs in most patients who receive treatment for cancer and in many, this fatigue does not resolve upon the completion of cancer treatment (Ahlber et al.) Head and Neck cancer patients who are diagnosed and receive treatments for their cancer may experience this fatigue. The National Comprehensive Cancer Network generally defines cancer related fatigue as a “distressing persistent, subjective sense of tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning,”(Mock et al.). The interference of usual activity

categorizes fatigue as a problematic side effect of cancer that effects quality of life for many HNC patients. Fatigue is a multidimensional condition and therefore requires a measure that encompasses the impact on a patient's life. The Functional Assessment of Chronic Illness Therapy Fatigue subscale is a measure used to quantify fatigue seen in cancer patients. This scale measures physical, emotional, and mental factors regarding fatigue. The association between physical activity and improved QOL is consistent with randomized controlled trials in cancer survivors other than head and neck (Stevinson, Lawlor, and Fox). In general, multiple studies of physical therapy rehabilitation involving physical activity exercises have been shown to improve QOL in cancer patients. Exercise has a powerful effect on cancer-related fatigue, and fatigue levels were 40% to 50% lower in exercising participants, even in studies with small sample sizes (NCCN). The NCCN recommends exercise programs monitored by rehabilitation providers for management of fatigue in cancer patients. The evidence supporting exercise as an intervention for fatigue is category 1 based on the number of studies conducted, good quality of the designs, large effect size of exercise on cancer-related fatigue, and consistent outcomes across studies (NCCN).

The review of current literature showed that few studies have been done that directly measures the correlation between fatigue in HNC patients and exercise. Rogers, Courneya, Robbins, Malone, Seiz, Koch, Rao, and Nagarkar conducted a cross sectional study to examine the prevalence of exercise in HNC patients and determine preliminary associations with fatigue. Fifty-nine HNC patients were recruited from an academic oncology clinic and completed a self-administered survey that included Godin Leisure-Time Exercise Questionnaire and Functional Assessment of Cancer Therapy-Head &

Neck. Participants were asked to report their level of physical activity before diagnosis and after diagnosis. The results showed zero-order correlations demonstrated that higher QOL was associated with greater total weekly activity minutes. The researchers note that the association between reduced fatigue and higher activity level noted in the study is consistent with that noted in prior studies among cancer survivors of other types (Rogers et al.).

The current research on fatigue and quality of life in head and neck cancer patients is behind research done on other cancer forms. The Rogers et al study stated that focusing future research efforts on the physical activity behavior of head and neck cancer patients is of particular importance because of the significant decline in physical activity after diagnosis, in spite of possible QOL benefits (Rogers et al.). Furthermore, physical activity potentially improves functional well-being and reduces fatigue, two particularly important issues for this patient population. Although there has been some evidence to suggest that physical activity improves wellbeing in HNC patients, most cancer patients do not stay active after diagnosis or remain sedentary despite possible benefits. The review of existing research represents a need for further research to establish evidence of QOL fatigue improvement due to rehabilitation using physical activity before a standard of practice will be able to be enforced in the head and neck cancer patient community.

Oral Health

Oral health is another factor of Quality of Life in patients suffering from head and neck cancers. Oral health discussed in this literature review will include issues involving pain, swallowing dysfunction, and trismus, also known as mandibular hypomobility. As

oral health in HNC patients is realized as a predominate issue, an increase in research with more prevalence in regards to physical therapy rehabilitation interventions is currently being conducted. Oral health issues are of importance in HNC survivorship as oral dysfunction can lead to malnutrition, which affects the overall role of HNC management.

One of the major components of oral health relating to QOL is pain. Ragnarsson et al. defined Physical therapy relating to cancer rehabilitation as including therapeutic exercises, active or passive mobilization techniques, graded and purposeful activity, relaxation, distraction, postural re-education, positioning, mobility, TENS, heat or cold, and massage therapy (Ragnarsson et al.) All of these interventions through physical therapy have been used in some combination to potentially increase QOL in head and neck cancer patients. Delbruck stated that massage for pain relief can have an effect on complex behavioral patterns as well as the simple perception of pain (Delbruck). Exercises commonly increase the subject's awareness of posture, motion patterns and breathing and are designed to heighten the patient's perception of the areas where pain originates and are a basis for active processing of pain by the patient (Wilcock, Herring, and Press).

A review study done by Alibhai, Thomas, and Bhandari indicated that they are physical therapy interventions effective for reducing swallowing dysfunction in head and neck cancer patients. Preventive strategies are carried out prior to surgery include range of motion and resistance exercises, which aim to improve swallow physiology and reduce the severity of disorders after surgery. They can be recommended once the physician has made a careful assessment and feels that the patient is at risk of developing deficiencies

after surgery. The aim of these strategies is to improve function of groups of muscles. Range of motion exercises improves movement of target structures and is available for oral tongue, tongue base lips, larynx and hyoid related muscles. Resistance exercises involve stretching the target and holding in extension for several seconds. They can be used for the tongue, jaw, larynx and lips. The review also stated that these same interventions can be utilized in post operations patients but more research is required to determine the effectiveness of such treatment. Clinical studies are currently being funded to compare different exercises for dysphagia in HNC patients (ALibhai, Thomas, and Bhandari).

Studies conducted by Van der Molen et al. and Bensadoun et al. examined trismus in head and neck cancer patients. A study done by Kaplan refers to cancer rehabilitation interventions for trismus patients. The temporomandibular joint (TMJ) dysfunction includes fibrosis due to radiotherapy, scarring, weakness and atrophy of the muscles producing the movements after surgery, and intraarticular damage due to radiotherapy and surgery, which leads to the stiffness of the joint. So the patients may feel difficult in the mouth opening, mastication, and speech (Van der Molen et al.). Other problems include headaches, usually at the temples and side of head, vague tooth soreness or toothaches, which often move around the mouth, pain and fatigue when eating hard or chewy foods, clicks, pops, or grinding sound in jaw joint, and cervical neck tension and pain (Bensadoun et al.) Range of motion exercises should be utilized to maintain movement of the lips, tongue, and jaw. Passive joint mobilization, re-education of the jaw movement, scar mobilization, and strengthening exercises to the jaw muscles play vital part after the surgery or chemoradiotherapy (Kaplan).

Physical therapy can help relax the muscles, increase joint flexibility, and the other oromotor exercises. The rehabilitation for preventing reduced mouth opening mainly concentrates on programs using different jaw-stretchers or mouth-opening exercises (Guru, Manoor, and Supe). Different devices are available for jaw stretchers, such as Therabite, the TMJ exerciser, and the Acute Medic jaw trainer and stretcher. A study conducted by Melchers et al. examined the exercise adherence for use of the Therabite. The Therabite was shown to have a substantially greater effect than other devices. The study was a multi-centre, formal-evaluative, qualitative, retrospective study that evaluated 22 subjects. The most important and most frequently mentioned factors were the internal motivation to exercise and the perceived effect, both having a positive influence on adherence; perceiving no effect had a negative influence. Other frequently mentioned factors were the limitation in the opening range of the Therabit1 and reaching the exercise goal or a plateau in mouth opening (negative influence), and self-discipline and having a clear goal for exercising (positive influence). As the above studies have shown, Therabite is an effective physical therapy intervention to manage trismus in HNC patients. Therabite adherence can positively affect the outcome of rehabilitation of trismus in HNC patients.

As the above studies have shown, pain, swallowing dysfunction, and trismus are all common side effects of HNC treatment interventions. The current research suggests that effective physical therapy interventions exist in managing symptoms regarding these side effects. Among the common interventions include strengthening exercises to maintain the function of muscles involved with swallowing, speaking, and chewing. Further research should be considered to determine the most effective integration of

interventions when treating head and neck cancer patients suffering from the above-mentioned side effects.

Rehabilitation Exercise and Lymphedema

Lymphedema is a build-up of lymph fluid in the fatty tissues just under your skin. This build-up causes edema, most often in the arms or legs. Lymphedema can result from surgery or radiation therapy to treat certain cancers. Because surgery, radiation, and/or chemotherapy disrupt lymphatic structures, damage soft tissue leading to scar tissue formation and fibrosis, and further affect lymphatic function, patients with HNC may be at a high risk for developing secondary lymphedema (Deng et al.). Secondary lymphedema can be categorized into both external and internal lymphedema. The high-risk nature of lymphedema occurrence in HNC patient calls for research on interventions from a physical therapy perspective.

A study conducted by Deng, Ridner, Dietrich, et al. examined the prevalence of lymphedema in patients with head and neck cancer. This is the first study in the United States to examine HNC patients and lymphedema patients. The study included 81 patients with head and neck cancer who were three months or more post-treatment. External lymphedema was staged using Foldi's lymphedema scale. Internal lymphedema was identified through a flexible fiber-optic endoscopic or mirror examination. Patterson's scale was used to grade degrees of internal lymphedema. Eligibility for participation included 1) ≥ 18 years of age, 2) three or more months after completion of head and neck cancer treatment, and 3) no current evidence of cancer. Individuals were excluded if they met one of the following criteria: 1) actively undergoing chemotherapy

or radiation therapy, 2) having metastatic cancer or any other active cancer, or 3) unable to understand the informed consent. Of the 81 patients, 75.3% (61 of 81) had some form of late-effect lymphedema. Of those, 9.8% (6 of 61) only had external, 39.4% (24 of 61) only had internal, and 50.8% (31 of 61) had both types. Secondary lymphedema is a frequent late effect in patients with head and neck cancer. Lymphedema may involve external or internal structures. In many patients, both external and internal structures are involved simultaneously. Thus, secondary lymphedema is an important clinical phenomenon that has the potential to cause significant symptom burden and function loss. Routine screening for lymphedema is warranted and, once identified, treatment is indicated. More studies are required to examine incidence, prevalence, natural progression of secondary lymphedema, and its impact on patients' quality of life (Deng et al.).

A review done by Guru, Manoor, and Supe provides evidence of physical therapy intervention to treat lymphedema. Conservative therapy of lymphedema involves a two-stage treatment program. The first phase consists of skin care, manual lymphedema treatment, remedial exercises, and compression applied with multilayered bandage wrapping. The bandaging achieves high tissue pressures during exercise but low pressures at rest. Simple elevation of a lymphedematous limb reduces swelling. Patients should be instructed to avoid heat, cold, local compression or excessive exercise of the affected arm. A specific exercise program performed once a day is aimed at augmenting muscular contraction, enhancing lymphatic flow and joint mobility, strengthening the limb and reducing the muscle atrophy. Phase 2 (initiated immediately after phase 1) consists of compression by low-stretch elastic stockings or sleeves, skin care, remedial

exercises, and repeated manual lymphedema treatment as necessary (Guru, Manoor, and Supe).

As the above literature indicates, head and neck cancer patients are at a high risk for developing lymphedema. There are currently conservative physical therapy interventions available for treatment of lymphedema. It is important to note that not all patients will respond to conservative methods and other rehabilitation methods such as surgery may be required. This review concentrates solely on physical therapy rehabilitation but it does not suggest that physical therapy is the only and/or most effective method of treatment for every patient experiencing the complications discussed. However, many patients may see benefits from physical therapy interventions and future research should be done on a wider population scale to determine the effectiveness of physical therapy treatment for lymphedema experienced by head and neck cancer patients.

Rehabilitation Exercise and Shoulder Dysfunction

Review of the current literature shows that one of the most extensively researched areas regarding head and neck cancer survivor is shoulder dysfunction. The current research is discussed below in chronological order from earliest (in the last 10 years) to the latest published research regarding physical therapy interventions for shoulder dysfunction.

McNeely et al. 2004 conducted a randomized control trial pilot study to evaluate the effects of progressive resistance exercise training (PRET) on shoulder dysfunction caused by spinal accessory neurapraxia/neurectomy in head and neck cancer survivors. The debilitating effect of neck dissection procedures on shoulder function is a well-

recognized surgical complication and is the result of temporary damage to (neuropraxia/axonotmesis) or resection of (neurectomy) the spinal accessory nerve. Twenty patients were randomly assigned to PRET or standard care intervention. Subjects assigned to the PRET group exercised three times per week for 12 weeks. The goal of the exercise program was to enhance scapular stability and strength of the upper extremity. These exercises consisted of rhomboids (scapular retraction); levator scapulae (scapular elevation); biceps (elbow flexion); triceps (elbow extension); infraspinatus, posterior deltoid (external rotation); and middle deltoid and supraspinatus and subscapularis (abduction in the plane of the scapula). The resistance-training program was progressive in terms of number of sets and repetitions performed, as well as the amount of weight lifted, depending on performance status. The completion rate for the trial was 85% (17 of 20). The exercise group completed 93% of scheduled exercise sessions. Significant improvements were found in favor of the PRET group in active shoulder external rotation ($p = .001$), shoulder pain ($p = .038$), and overall score for shoulder pain and disability ($p = .045$). A clinically significant finding of the study was that the PRET program had a beneficial effect on pain.

A Review done by Lauchlan et al. 2008 critically reviewed the literature regarding neck dissection (ND) for head and neck cancer and the role of physical therapy. Symptoms of neck dissection include drooping of the involved shoulder, limited forward flexion, limited active lateral abduction, a constant dull ache, a sensation of stiffness or soreness in the involved side, aberrant scapular rotation and abnormal EMG activity. Post-operative rehabilitation is not commonplace in the standard management of patients following ND. Referral to physical therapy is often made after symptoms progress. This

secondary condition can have an impact in the patient's QOL; affecting sleep, ADL, involvement in social and sporting activities, and general lifestyle events. The review notes that although physical therapy intervention has been found to be effective in reducing symptoms in postoperative shoulder disability, there has been little agreement on which intervention is the most effective. The review by Lauchlan et al. calls for more research with a more rigorous study design to help test a standardized protocol of intervention.

A randomized controlled trial conducted by McNeely et al. 2008 examined the effect of exercise on upper extremity pain and dysfunction in head and neck cancer patients. Fifty-two head and neck cancer survivors were assigned randomly to PRET (n=27) or a standardized therapeutic exercise protocol (TP) (n= 25) for 12 weeks. The primary endpoint was change in patient-rated shoulder pain and disability from baseline to post intervention. Secondary endpoints were upper extremity strength and endurance, range of motion, fatigue, and quality of life. The therapeutic exercise protocol consists of supervised active and passive ROM/stretching exercises, postural exercises, and basic strengthening exercises with light weights (1–5 kg) and elastic resistance bands. The specific strengthening exercises focused on the following muscle groups: rhomboids/middle trapezius; levator scapula/upper trapezius; biceps; and triceps, deltoid, and pectoralis major. The PRET program replaced the basic strengthening exercises of the TP protocol and was performed for the same muscle groups as the TP protocol. However, the PRET protocol was tailored to each survivor based on baseline testing results and was prescribed with the intent to provide progressive overload to the specific muscle groups. The program consisted of 2 sets of 10 to 15 repetitions of 5 to 8 exercises,

starting at 25% to 30% of their 1-repetition maximum (1-RM) strength and slowly progressing to 60% to 70% of their 1-RM strength by the end of the intervention period. The study concluded that the PRET program significantly reduced shoulder pain and disability and improved upper extremity muscular strength and endurance in head and neck cancer survivors who had shoulder dysfunction because of spinal accessory nerve damage. Clinicians should consider the addition of PRET in the rehabilitation of postsurgical head and neck cancer survivors.

An exploratory trial was conducted by Lauchlan et al. 2011 to investigate the gap in current literature regarding preventative rehabilitation on shoulder disability and quality of life in patients following neck dissection surgery. Thirty-two subjects were randomly assigned to either one of two groups: early physiotherapy for a period of 3 months following surgery and current routine inpatient care and advice. Subjects in the control group received routine post-operative physiotherapy care while in hospital, recovering from surgery. This consisted of routine respiratory care and advice on early active movement of the neck and affected shoulder. Advice was given verbally without any structured patient handout or any diagrams displaying specific exercises. In addition to routine postoperative physical therapy care, the intervention group also undertook a 3-month period of outpatient physical therapy, immediately on discharge from hospital. They also received a patient advice and instruction leaflet, outlining specific progressive neck and shoulder exercises. Blinded measurement of shoulder function and QOL were recorded pre-operatively and at 1 year following surgery. No difference was found using between-group analysis (Mann–Whitney U-Test) for any outcome measures observed. Descriptive data analysis suggests that subjects receiving early physiotherapy had a

perception of increased physical wellbeing when compared with subjects receiving routine care. There may be some clinical significance that subjects receiving a course of physiotherapy did appear to rate their physical well-being higher than those subjects not undergoing rehabilitation. Further research to investigate the preventative effects of physical therapy on this population should consider the use of head and neck cancer-specific outcome measurement of both shoulder disability and QOL.

The literature available on physical therapy as a management technique for shoulder dysfunction and disability shows that improvements are being made in regards to effective interventions. PRET interventions have been shown in pilot and randomized controlled trials to be an effective method of treatment. The same research team conducted these studies and therefore further investigation should be pursued in the future to validate these findings. Randomized trials also show potential benefit for preventative physical therapy rehabilitation following neck dissection surgery for HNC patients. A review of the above studies concludes that although shoulder dysfunction is one of the more investigated symptoms of HNC, further research must be done to develop an effective standard protocol of care for patients

Adherence and Feasibility

Adherence and Feasibility to physical therapy implemented exercise interventions are important factors regarding the success of developing and utilizing a standard protocol of care for head and neck cancer patients. A standard protocol is only effective when the patients are both able and willing to comply with the necessary exercises.

Although feasibility and adherence is subjective to each particular set of interventions studied in the current literature, a basic knowledge of these factors is necessary to promote effective research in the future.

In the McNealy et al. 2004 study previously mentioned discusses adherence for PRET was determined. For instance, the adherence to the PRET program of 93% was higher than the adherence rates reported in a physical exercise trial in breast cancer (71.5%) and a resistance exercise program for prostate cancer (79%). This study's results demonstrate an interest in, and a high rate of adherence with, our PRET program among patients with head and neck cancer. The study also discussed the possibility of adherence to a PRET intervention during radiation therapy. With close supervision and monitoring of weight, hydration, and caloric intake, researchers feel that subjects can safely exercise during radiation therapy (McNealy et al. 2004).

A randomized controlled study conducted by Van der Molen et al. assessed the effect of preventive rehabilitation on swallowing and mouth opening after concomitant chemoradiotherapy and the feasibility and compliance of such rehabilitation in head and neck cancer patients. Forty-nine patients with advanced oral cavity, oropharynx, hypopharynx and larynx, or nasopharynx cancer treated with CCRT were randomized into a standard (S) or an experimental (E) preventive rehabilitation arm. The study showed that 34 patients (69%) could perform the exercises immediately and the remaining 15 patients were able to perform the exercises within a week. Twenty-six patients (53%) did not have any problems with any of the exercises. The remaining 23 patients (47%) had problems mainly with the swallowing (strength) maneuvers. With respect to the appreciation for the exercises, 10 patients (20%) liked the exercises, 25

patients (51%) were neutral about the training, 12 patients (25%) did not like them, and only 2 patients (4%) really disliked the exercises. The overall score for the expectation about the effectiveness of the exercises was good: 44 patients (90%) thought the exercises were helpful. The familiarity with the exercises score and the trial-specific questionnaire evaluated adherence with the exercise program. None of the patients had done logopedic therapy prior to their cancer treatment and therefore all patients initially scored “not at all familiar with the exercises.” After treatment, 28 patients (57%) scored “very familiar with the exercises,” 15 patients (31%) were “fairly familiar with the exercises,” and 6 (12%) were “not at all familiar with the exercises.” The study concluded that these particular exercises were feasible and HNC patients would be able to adhere to them (Van der Molen et al).

In the McNeely et al. 2008 study previously discussed in shoulder dysfunction measured predictors of adherence to an exercise program. The exercise adherence rate for the trial was 91%. The TP and PRET group patients attended 87% (standard deviation (SD) \pm 24) and 95% (SD \pm 11) of their total exercise sessions, respectively. The strongest predictor of exercise adherence for this trial was self-reported alcohol intake. Although few participants reported regular (daily) alcohol consumption, those who did had poorer overall adherence to exercise. The study concluded that excellent adherence to exercise was achieved in the trial despite high morbidity associated with HNC treatment. The high adherence achieved was likely due to the select and highly motivated sample of HNC survivors as well as to factors associated with trial design such as the support offered to participants. The findings of this trial need to be further explored and confirmed in a larger study that includes a more diverse sample of HNC survivors.

Adherence and feasibility of exercise programs used as physical therapy interventions are an important factor of continuing research of head and neck cancer survivor care. The reviewed studies show positive adherence and feasibility rates. The effectiveness of interventions should be measured in changes in quality of life, reduction of symptoms and also the adherence and feasibility of the intervention. As prognosis of cancer continues to be improved due to advancements there will be a larger number of HNC survivors in need of rehabilitation to manage their symptoms. Future studies regarding rehabilitation exercise to treat head and neck cancer patients should include these factors into their studies as well as other individualized studies measuring adherence and feasibility. It is possible that high adherence and high feasibility of interventions will lead to a more effective standard protocol of care.

Conclusion

Head and neck cancer survivors often suffer from high morbidity associated with treatment. Rehabilitation exercise has positive outcomes that may potentially increase quality of life in head and neck cancer patients. Improvements in fatigue, oral health, lymphedema, and shoulder dysfunction have been investigated by various studies discussed in this review. Related studies state a high feasibility and adherence rate for exercise program interventions. The view of current literature reveals that although research is progressing, further investigation with stricter guidelines is warranted to validate the effectiveness of physical therapy interventions in HNC patients. The current studies utilized different measures to describe possible correlations. The sample groups from these studies are often survivors from one clinic or geographical area. It is suggested that a large, long term randomized controlled trial be utilized to prevent

inductive reasoning errors when establishing results. The goal of future research is validation in an effective treatment protocol so that a standardized method may be put into place for head and neck cancer survivors. A standard protocol would decrease both the lack of knowledge and the communication barriers preventing effective management of HNC symptoms.

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