Pain is a physical sensation experienced through a perceived or actual tissue injury (Majithia et al., 2016). When symptoms of pain persist outside the time of tissue injury and healing, it can be maladaptive and considered a chronic disease state (Majithia et al., 2016). Conventional treatments of chronic pain consist of opioids, neuroleptics, physical therapy, regional anesthesia, and neuromodulation (Campagnone & Tagliaferri, 2015). Both adults and children experience chronic pain. Characteristics of chronic pain are symptoms that endure or reoccur for at least three months (Park, Kim, Kim, & Yoo, 2017). Common conditions causing chronic pediatric pain (CPP) include cancer related neuropathic pain associated with platinum-based chemotherapeutic drugs (e.g. Cisplatin) (Park et al., 2017) and complex regional pain (CRP) a type of chronic neuropathic pain that is characteristically contained to one limb and develops due to a noxious stimulus from trauma, surgery, or a stroke (Raucci et al., 2016). To understand the indications for ST, it is essential to review the characteristics of chronic pain in children. Pediatric chronic pain disorders frequently respond inadequately to traditional pain treatments, because the pain conduit and source produces a complicated apparatus of pain mechanism (Raucci et al., 2016). Chronic pain is thought to occur due to dysregulation of the pain pathway (Raucci et al., 2016). It is postulated that in chronic pain neurons proximate to damaged tissue can trigger impulses that communicate pain data with the absence of external input (Majithia et al., 2016). The result can be somatic and sensory symptoms produced by chronic pain syndromes (i.e. peripheral neuropathy and CPS) such as sharp pain, numbness, tingling, pressure, vasomotor changes, autonomic, motor dysfunction, and central nervous system changes (Raucci et al., 2016). Moreover, patients with recurring pain stimuli can experience modifications that subsequently result in a reduced pain threshold (Majithia et al., 2016). Hence, there is damage to the nerve endings that result in in pain signals that cannot turn off even though the surrounding tissue has healed. ST was developed by Giuseppe Marineo (2003) and a team of researchers in Rome, Italy. ST is a noninvasive, electrocutaneous stimulation (neuromodulation) device that was found to be effective in reducing pain symptoms in patients with terminal cancer who did not respond well to standard pain treatment (Majithia et al., 2016). The mechanics of ST are not well-defined, but Marineo, Iorno, Gandini, Moschini, and Smith (2012) hypothesized that the device interrupts afferent pain impulses through C-fiber surface receptors and replaces them with synthetic no pain data through cutaneous nerves with the application of surface electrodes surrounding the identified...
painful areas of the body (Park et al., 2017) (Fig. 1). Unlike the current conventional electro-analgesia (e.g. transcutaneous electrical nerve stimulation [TENS], and implanted spinal cord devices), that block pain information, ST works through a process termed plasticity (Southall, 2016). The process of plasticity retrains the brain and introduces a pleasurable perception that acts as a disruption by sending a new message to nerve fibers that where accustomed to receiving noxious stimuli (Lesenskyi et al., 2017). Minor complications noted with ST include skin irritation or bruising beneath the site where the electrode leads are placed (Southall, 2016). If the patient uses anticonvulsants (e.g. neurontin) for analgesic purposes, it is important to consider weaning the drug because the effects of ST is deficient especially at high doses of the drug (Marineo et al., 2012). Anticonvulsants may cause an opposing mechanism by counteracting the stimulus to progress along the nerve fibers (Raucci et al., 2016). Concerns of ST are the cost of purchasing the equipment and training of practitioners. ST requires specialized training, and the success of treatment is known to be dependent upon correct placement of the electrodes (Congedi et al., 2016) and the regulation of the stimulation intensity (Southall, 2016). Like any new therapy, the significance of the practice relies upon research conducted within the adult patient population. Some of the clinical studies include chronic pain conditions such as brachial plexus injury, a wide range of refractory chemotherapy neuropathic pain induced bone and visceral metastases, failed back syndrome and spinal cord stenosis (Congedi et al., 2016). The results of the adult studies showed a decrease in pain intensity and a suspension of pain medication after one to five treatments (Marineo et al., 2012). Also, various results in pain reduction have been documented from thirty to hundred percent from baseline with a continued duration from two-weeks to three months (Coyne, Wan, Dodson, Swainey, & Smith, 2013; Moon et al., 2015; Notaro et al., 2015; Starkweather, Coyne, Lyon, Elswick, & Sturgill, 2015.). Most of the success of ST occurred with neuropathic pain syndromes (Moon et al., 2015). Treatment failure transpired with traumatic/surgical etiologies and the use of antidepressant (Moon et al., 2015). Also, it is important to note that there were no significant complications noted or recorded with any of the studies conducted (Majithia et al., 2016). There are two case reports in the literature about the use of ST in the pediatric population. One a seven-year-old female with minimal change congenital myopathy, scoliosis with a subsequent contracture, and edema of the paravertebral musculature (Congedi et al., 2016). The child developed severe acute nociceptive and neuropathic scapular pain refractory to high dose opioids, benzodiazepams, and anti-inflammatory agents (Congedi et al., 2016). The other case is an eleven-year-old female with neuropathic pain in the mid-thigh and groin area (obturator nerve involvement) related to chemotherapy treatment (Park et al., 2017). Both cases reported similar results congruent with adult studies: ST resulted in a reduction in pain scores, decrease use in pain medication and an increased duration of pain relief over a two-month period (Congedi et al., 2016; Park et al., 2017). The overall positive outcomes and extent of pain relief with ST are thought to occur due to a remodulation in the peripheral and “central nervous systems within the calcium channels of the synapse, which are the critical focus for treating neuropathic pain” (Congedi et al., 2016, p. 5). ST is a noninvasive medical device with encouraging results and may be a safe alternative to chronic refractory pain in the pediatric patient population. The majority of the research of ST in adult patients demonstrates relief of symptoms in neuropathic and mixed pain syndromes without serious side effects. Highlighting a few of the pediatric cases published in the literature describes how ST might be beneficial to children as well. Still, more research is needed including sizable, double-blinded clinical trials to appraise the efficacy of ST for adults and children. Furthermore, deficiencies with standard therapies along with the increase of prescription opioid misuse encourages the necessity to foster alternative methodologies for treating chronic pain for both adults and children (Lesenskyi et al., 2017).