IONTOPHORETIC TREATMENT IN KNEE OSTEOARTHRITIS: NON PHARMACOLOGICAL THERAPY

RAJIV TONK[a] , PARUL SHARMA[b]

a- Head and Associate professor, Department of Pharmaceutics chemistry, Delhi Pharmaceutical science and research university, New Delhi.

b- Assistant professor, Department of physiotherapy, Delhi pharmaceutic science and research university, New delhi.

ABSTRACT

Osteoarthritis is the most common joint disease; in the near future, it is projected to rank second for women and fourth for men in the developed countries in terms of years lived with disability. Elderly patients are most often affected (joint diseases account for half of all chronic conditions in persons aged 65 years and over) and, because the number of individuals over the age of 50 years is expected to double worldwide between 1990 and 2020, the global burden of osteoarthritis will increase dramatically. In Europe by 2010 there will be more people aged over 60 years than under 20 years, and by 2020 these elderly individuals will represent 25% of the population. Come 2025 and India is likely to notice an endemic of osteoarthritis with about 80 percent of the 65 and above population in the country suffering with wear and tear of joints. Therefore, innovative and cost-effective approaches that can prevent the development and progression of OA are urgently needed . We need to improve the treatment strategies for osteoarthritis in order to decrease costs, enhance osseointegration and minimize wear, osteolysis and loosening and side effects of oral NSAIDs. Use iontophoresis technique in clinical trials which will be cost effective, having minimal adverse effects , maximum penetration and strong deeper effect on affected area to decrease pain and swelling and thereby, we can prevent disease progression and improve activities of daily living so that we can decrease the number of osteoarthritic patients.

Keywords: osteoarthritis, Iontophoresis, cost effective approach.

INTRODUCTION

Osteoarthritis (OA) is a chronic degenerative disorder of multifactorial etiology characterized by the loss of articular cartilage, hypertrophy of bone at the margins, subchondral sclerosis. There is remodelling of subarticular bone, osteophyte formation, ligamentous laxity and weakening of periarticular muscles. Pathological changes in the late stage of OA include softening, ulceration, and focal disintegration of the articular cartilage. Synovial inflammation also may occur . Typical clinical symptoms are pain, particularly after prolonged activity and weight-bearing; whereas stiffness is experienced after inactivity.It is probably not a single disease but represents the final end result of various disorders leading to joint failure. It is also known as degenerative arthritis, which commonly affects the hands, feet, spine, and large weight-bearing joints, such as the hips and knees. Among the chronic rheumatic diseases, hip and knee osteoarthritis (OA) is the most prevalent and is a leading cause of pain and disability in most countries worldwide. Its prevalence increases with age and generally affects women more frequently than men. OA is strongly associated with aging and heavy physical occupational activity, a required livelihood for many people living in rural communities in developing countries. (Chandra Prakash Pal, Pulkesh Singh, 2016 [1]

PREVALENCE

Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with prevalence of OA in India is reported to be in the range of 17%–60.6%. OA is more common in women than men, but the prevalence increases dramatically with age. Nearly, 45% of women over the age of 65 years have symptoms while radiological evidence is found in 70% of those over 65 years. OA of the knee is a major cause of mobility impairment, particularly among females. OA was estimated to be the 10th leading cause of nonfatal burden.

MAJOR RISK FACTORS

Obesity is one of the leading and greatest modifiable , risk factors for the development of osteoarthritis (OA). It is a progressive degenerative disorder that leads to joint damage, chronic pain, muscle atrophy, decreased mobility, poor balance and eventually physical disability. Arthritis is becoming pandemic globally and its presence with obesity and diabetes is being observed more commonly than ever.

REVIEW OF LITERATURE (METHODOLOGY)

The study was to compare the effects of transcutaneous electrical nerve stimulation (TENS) and sodium salicylate Iontophoresis on pain and functional disability in patients with osteoarthritis of the knee. Twenty (20) subjects participated in this study. Sodium salicylate iontophoresis had a more statistically significant reduction of pain and

functional disability in comparison with TENS group . Iontophoresis may be considered as an alternative therapy in knee osteoarthritis that is inexpensive, simple and non-invasive. (Kola-Korolo TA, [2]

Many treatment options, including non-pharmacological and pharmacological measures, have been recommended in the management of osteoarthritis (OA). Among the non-pharmacological approach is physiotherapy, which involves the use of physical modalities like, heat therapy, exercise therapy, electrical stimulation, therapeutic ultrasound, iontophoresis, and phonophoresis. This study was therefore designed to compare the effectiveness of 0.4% Dexamethasone sodium phosphate (DEX-P) phonophoresis (PH) with 0.4% DEX-P iontophoresis (ION) therapy in the management of patients with knee joint OA. Both therapeutic modalities were found to be effective and generally well tolerated after 10 treatment sessions. DEX-P phonophoresis was not superior to DEX-P iontophoresis in the treatment of patients with OA of the knee. PMID: 17767200 .(Akinbo SR1, Aiyejusunle CB, [3]. 40 patients with knee osteoarthritis to whom ketoprofen gel iontophoresis was applied. Pre-treatment and post-treatment pain, functional status and physical limitation were evaluated by Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Lequesne Index, respectively. There was significant difference between the pre- and post-treatment evaluation in all parameters ($p<0.05$). Conclusion: Iontophoresis may be considered as an alternative therapy in knee osteoarthritis that is inexpensive, simple and non-invasive .(Altındağ Özlem, Neslihan, 2009, [4]. Transdermal administration of corticosteroids via iontophoresis allows for localized delivery, thus bypassing many of the problems with systemic administration. The potential safety benefits are compelling, but efficacy data have been conflicting. Most data suggest that iontophoresis facilitates dexamethasone penetration into human tissues. We reviewed 13 clinical trials that met criteria for muscle soreness, carpal tunnel syndrome, osteoarthritis of the knee, rheumatoid arthritis of the knee, plantar fasciitis, trapeziometacarpal arthritis, Achilles tendon pain, and epicondylitis. ,(John Torro, MDLuigi Brunetti,2011, [5]. Transdermal administration of corticosteroids via iontophoresis allows for localized delivery, thus bypassing many of the unwanted toxicities and nuisances, as well as the invasiveness of an injection. In this article, we provide a concise review of the literature related to iontophoresis of dexamethasone in musculoskeletal conditions. Glass and colleagues evaluated penetration of dexamethasone administered with iontophoresis into the tissue of rhesus monkeys. The researchers concluded that dexamethasone readily penetrates the epidermis and reaches the desired joint layers (muscle, synovium, joint capsule, and cartilage) at depths of 17 mm.

In another study, Gurney and associates evaluated the penetration of cathodic iontophoretic (40-mA-minute dose) administration of 0.4% dexamethasone in 16 adults undergoing anterior cruciate ligament reconstruction and concluded that iontophoretic administration of dexamethasone penetrates human connective tissue with skin-fold thickness up to 30 mm.

Jain and colleagues19 completed a randomized, placebo-controlled, double-blind study to evaluate dexamethasone iontophoresis for the management of TMC arthritis pain and concluded that transdermal delivery of corticosteroids might not be helpful in managing arthritis pain in both the short and long term.

Neeter and coworkers evaluated the effectiveness of dexamethasone iontophoresis in managing Achilles tendon pain in 25 patients.and concluded that dexamethasone iontophoresis has a role in managing acute Achilles tendon pain. Two studies evaluated the effectiveness of dexamethasone iontophoresis in managing epicondylitis. These data suggest that dexamethasone iontophoresis has at least a short-term benefit in epicondylitis. (Surendra K Wani, Nashik, India, 2013, [6]. Methyl salicylate iontophoresis can be included in the treatment of knee osteoarthritis to enhance pain relief and functional activity.

The study compared the inclusions of 5% Ibuprofen Iontophoresis Compared with Transcutaneous Electrical Nerve Stimulation in the Management of Knee Osteoarthritis: (Ajediran I. Bello*, Shika Kuwornu, 2014, [7]. The patients in both groups demonstrated significant improvement in the pain, AROM and walking speed after six weeks of treatment .

Xiaoying et al., reported that iontophoresis facilitated local and systemic delivery of ionisable drugs such as ibuprofen and sodium diclofenac, compared with passive diffusions. The study revealed that the concentrations of sodium diclofenac in the skin, subcutaneous tissue and muscle beneath the drug application site (cathode) were significantly greater than plasma concentrations and the concentrations of drug in similar tissues at the untreated sites.

Allen recommended that in view of the adverse effects of prolonged, orally administered non-steroidal anti-inflammatory drugs (NSAIDS) on the gastrointestinal system of patients particularly, elderly OA patients, iontophoresis is a much safer means of offering drug therapy . Study has shown that the ample depth of penetration of therapeutic concentrations of drugs into joints through iontophoresis was 1.7 cm and provides much higher local concentrations compared with oral medication and injections . Glucosamine application via iontophoresis was more effective in pain reduction in knee osteoarthritic subjects than through transdermal massage. (Onigbinde, RA Adedoyin, [8] .

Tramadol iontophoresis added to therapy is superior to the therapy methods alone (transcutaneous electrical nerve stimulation (TENS), hot pack, ultrasound, and exercise therapy) in patients with knee OA. We conclude that tramadol iontophoresis added to physical therapy may be useful for relieving pain of knee OA during the treatment period. (Turhanoğlu, Ayşe Dicle; Güler, 2010, [9]

RESULTS

There are 20 articles reclaimed from google scholar, pubmed and springer link. Not any other extra acceptable studies were reclaimed from consecutive electronic database or biographic searches. The result of whole article is that Iontophoresis has significant results in knee osteoarthritis **.**

DISCUSSION

The purpose of this study was to review the effect of iontophoresis in knee osteoarthritis. For this, many studies were selected from PubMed and Google scholar through various trials.There are various studies that shows efficacy

on osteoarthritic patients . The pain can be of Musculoskeletal or Neurological origin. The use of Iontophoresis have been shown on various musculoskeletal disorders such as lateral epicondylitis. Juvenile Idiopathic arthritis (Temporomandibular joint involvement), Acute Achilles tendon pain, Plantarfascitis, bursitis etc. (Stefanou A, Marshall N, 2012, [10]. Not only this but various neurological disorders which produces pain such as carpal tunnel syndrome,trigeminal neuralgia,neuropathic pain etc.(Gokoglu F, FndkogluG, 2005, [11] . The study has been shown to have positive results.In certain connective tissue disorders such as Peyronie's disease it produces significant relief in pain. (Stasi S,GiannantoniA ,2004, [12].

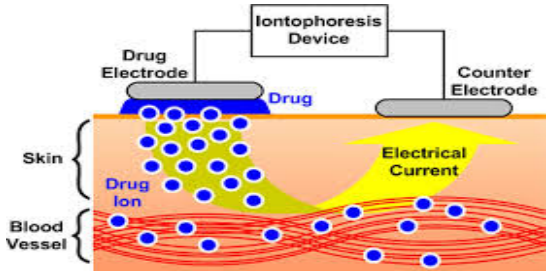
Various drugs which can be used for pain relief are: Dexamethasone, Verapamil, Lidocaine, Fentanyl Hydrochloric acid, Opiods etc (Br J,'Fentanyl , 2007, [13].

IONTOPHORETIC ADMINISTRATION

For drugs to be viable candidates for iontophoresis, they must have the ability to transfer electrical energy (must be charged). In addition, both drug concentration and drug physiochemical properties must be considered because they influence the extent of transdermal delivery. Data on the effectiveness of iontophoresis in facilitating corticosteroid penetration through the skin are conflicting.

The Iontophoresis has many advantages compared to drugs administered orally or via needle:

1. Unlike injections, is a painless therapy
2. more concentrated doses of medicines may be given with respect to medications taken by mouth
3. avoids the side effects, because the medicine "reaches for destination" and does not affect other organs
4. precisely because it is a localized treatment, is faster and the patient is quicker relief from its malaise
5. For many patients, the electrodes have a pleasant massage effect. (December 6, 2016, Uncategorized, Cellulite and Adiposity, Joint Pain, Body Care, Health and wellnessOsteoarthritis, cellulite, Hyperhidrosis, muscle tears, bone and joint pain, lumbago, Iontophoresis: the benefits of this therapy is painless and effective)



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Many treatment options, including non-pharmacological and pharmacological measures, have been recommended in the management of osteoarthritis (OA). Among the non-pharmacological approach is physiotherapy, which involves the use of physical modalities like, heat therapy, exercise therapy, electrical stimulation, therapeutic ultrasound, iontophoresis, and phonophoresis. This study was therefore designed to compare the effectiveness of 0.4% Dexamethasone sodium phosphate (DEX-P) phonophoresis (PH) with 0.4% DEX-P iontophoresis (ION) therapy in the management of patients with knee joint OA. Both therapeutic modalities were found to be effective and generally well tolerated after 10 treatment sessions. DEX-P phonophoresis was not superior to DEX-P iontophoresis in the treatment of patients with OA of the knee.(Niger Postgrad, 2007, [14]. Comparison of the therapeutic efficacy of phonophoresis and iontophoresis using dexamethasone sodium phosphate in the management of patients with knee osteoarthritis).

Various physical therapy modalities which can be used for pain relief are:Iontophoresis(Nirschl R, Rodin D, 2003, [15]. Ultrasound, Phonophoresis , Electrical stimulation (Transcutaneous Electrical Nerve Stimulation (Pop T,Austrup H, 2010, [16]. Low Level (cold) Laser therapy(Turhani D, Scheriau M, 2006, [17].

Iontophoresis: It is a technique of facilitation of ionic movements across a membrane under the influence of an externally applied potential difference and it is one of the most promising physical skin penetration enhancing method.(Dixit,Nitin,BaliVikas et al, 2007, [18]. Iontophoretic drug delivery occurs by a combination of: concentration gradient,increased skin permeability under applied electric current,a current induced water transport effect.(Singh P, 1994, [19]. The most common route for transmission of drug through Iontophoresis is Transdermal route. Transdermal Iontophoresis is process of administration of ionic therapeutic agents using low-level electric current through the skin.(Kanikkannan N, 2002, [20]. Various parameters should be taken into account that can affect transdermal absorption of drugs through Iontophoresis like drug concentration,ph of donour solution,drug polarity, presence of co-ions,ionic strength,electrode polarity etc.

The enhanced penetration due to Iontophoresis was observed mainly along the hair follicles in the skin especially in the deeper layers (20-40µ below the skin surface). Involvement of non-appendageal pathways for iontophoretic transport has also been suggested(34),which includes the creation of artificial shunts due to disruption of the stratum corneum structure,(Singh P, 1994, [21], a temporary pore formation due to ‘flip-flop’ movement in the polypeptide helices in the stratum corneumor pathways of least resistance created by damaged skin areas.In addition,other factors such as the source and structure of skin and the density of hair follicles will contribute to the determination of the transport pathways.(Riviere JE, 1997, [22].

Combination of Iontophoresis of small molecules with other enhancement strategies has also successfully led to significant permeation enhancement through the skin. Tiwari and Udupa (Tiwari SB ,2003, [23] found that the combination of chemical and physical enhancer pre-treatment (ultrasound,Iontophoresis and pre-treatment with 5% D-limonene in ethanol) gave rise to a flux that was significantly different from Iontophoresis alone as well as for treatment with the chemical enhancers and ultrasound alone.

Advantages: Iontophoresis also provides increased patient compliance due to less frequent dosing, ease of terminating drug delivery at any stage of therapy and the capability of tailoring drug therapy at pre-programmed rates according to individual needs.(Singh P, 2006, [24]. Iontophoresis is also finding value in drug delivery via other drug administration routes such as transcorneal and trans-scleral routes, and also through bone for delivery of antibiotics to prevent infection during allograft implantation.(Khoo PP, 2006, [25].

CONCLUSION

As illustrated in various studies that Iontophoresis with various drugs are widely being used for relief of pain and reduction of some other symptoms in knee osteoarthritis .Although there are various modalities or drugs in knee osteoarthritis. Iontophoresis treatment was well tolerated by most patients and was effective in reducing symptoms in osteoarthritis.

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ETHICAL CLEARANCE:- Ethical clearance has not been taken from institute.

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