RESEARCH ARTICLE

Viscosupplementation for improvement in pain and mobility in knee osteoarthritis : A retrospective cross sectional study.

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Abstract

Objective: To evaluate pain and mobility improvement in knee osteoarthritis patients after hyaluronic acid viscosupplementation.

Method: The cross-sectional, retrospective study was conducted at the Department of Orthopaedics, Aga Khan University Hospital, Karachi, and comprised data from January 2019 to December 2022 of patients having knee osteoarthritis who had received viscosupplementation with hyaluronic acid gel. Western Ontario and McMaster Universities Osteoarthritis Index score was calculated at baseline and on patient follow-up at 12 months. Data was analysed using SPSS 23

Results: Of the 180 patients with mean age 61.1+/-11.4 years, 109(60.6%) were females and 71(39.4%) were males. Mean baseline score was 69.6+/-8.3, which went down to 48.2+/-10.6 post-intervention ($p<0.05$), with significantly greater improvement in patients with mild to moderate knee osteoarthritis compared to those with advanced osteoarthritis ($p<0.05$).

Conclusion: Viscosupplementation with hyaluronic acid significantly improved outcomes in knee osteoarthritis cases over one year. Benefits were more notable in mild to moderate cases.

Key Words: Knee osteoarthritis, Hyaluronic acid gel, WOMAC score, Viscosupplementation, Improvement in pain.

Level of Evidence : IV

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Introduction

Osteoarthritis (OA) is as a chronic degenerative joint disease that is characterised by joint pain, stiffness, joint space narrowing, and degeneration of the joint cartilage.[1] OA is associated with activity-related pain, which becomes a feature of the disease as the disease progresses later in life.[2] Epidemiological studies have shown that OA is the most prevalent joint disease and its incidence increases with age.[3] Moreover, at present OA remains an incurable disease, which increases the risk of functional disability, and severely affects the quality of life (QOL) of individuals, making it imperative to explore the different available treatment options. The knee is a common site of OA, and individuals with knee OA exhibit a characteristic pattern of decrements in function, generally concerning mobility, transfer from seated or supine position to standing, and activities of daily living (ADLs) involving the lower extremities. Knee OA is prevalent among adults aged ≥60 years with global prevalence and incidence rates of 16% and 203 per 10,000 person-years, respectively.[4]

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The treatment options for OA are mainly aimed at reducing and controlling the pain which allows the patient to maintain the function of the affected limb and slow down the progression of the disease process. Furthermore, other aims of OA treatment include maintaining joint mobility, reducing stiffness and improving the overall QOL.[5] Although there is a dire need for medications that can reverse the natural course of the disease and reduce joint cartilage destruction in OA, no such satisfactory treatment has been recognised so far.[6] The mainstay treatment options available for OA include a wide range of oral administration of analgesics, like non-steroidal anti-inflammatory drugs (NSAIDs) and intra-articular injections, which have proved to be successful symptomatic treatment options that delay the need for surgical interventions. Weight management for obese individuals, physical therapies and range of motion (ROM) exercises, and replenishment of nutritional deficiencies have also been used successfully along with pharmacological treatment options.[7]

Oral analgesics like NSAIDs, acetaminophens, and opioids (like tramadol) have temporary effect in the management of pain related to knee OA.[8] NSAIDs are known to cause adverse effects on gastrointestinal, renal and cardiovascular systems of elderly patients that outweigh the benefits provided by this option, often leading to the occurrence of other iatrogenic issues. On the other hand, short-term therapy of opioids can be used in individuals where NSAIDs are contraindicated for any reason, but long-term use of opioids is not recommended due to its limited effectiveness and its ability to cause addiction.[9] As a treatment alternative, viscosupplementation with hyaluronic acid (HA) has the potential to show significant enhancement in the individual's QOL.

Compared to oral medication, intra-articular injections of HA have been demonstrated to minimally interfere with systemic pathophysiology, resulting in the successful management of symptoms without significant adverse effects. HA is a linear chain polysaccharide that is endogenously produced in synovial joints to lubricate and act as a shock absorber in the joint. Besides, HA also acts to reduce inflammation and pain, protects joint cartilage from wear and tear, and stimulates the synthesis of glycosaminoglycan and proteoglycan.[10] Intra-articular HA injections have been proven to be safe in the treatment of knee OA, and have shown impressive outcomes by minimising pain and improving joint function, although the extent of its outcomes is variable.[10]

Endogenously produced HA has a short half-life, therefore exogenous HA preparations are synthesised by multiple methods to prolong their half-life and increase its effectiveness.[11] The recently available forms of HA injections have significantly gotten better in recent years. The high-molecular-weight HA has significantly superior outcomes in knee OA than low-molecular-weight HA.[12] Crosslinking of HA improves its mechanical, rheological, and swelling properties, as well as reduces its degradation rate.

The Western Ontario and McMaster Universities Osteoarthritis (WOMAC) Index is widely used in assessing outcomes after knee OA therapy.[13] The current study was planned to assess improvement in pain and mobility via the WOMAC scoring of patients with knee OA after HA viscosupplementation.

Patients and Methods

The cross-sectional, retrospective study was conducted at the Department of Orthopaedics, Aga Khan University Hospital (AKUH), Karachi, and comprised data from January 2019 to December 2022 of patients having knee OA who had received HA viscosupplementation. After approval from the institutional ethics review committee, data of patients aged >40 years who had to the outpatient department (OPD) with knee OA and were found to have knee OA grades 2-4 on radiography using the Kellgren-Lawrance radiological scoring (KLS) system[14] if they had a symptom duration of at least six months despite taking oral medications. Those with lower limb fractures, septic arthritis, pregnancy and recent history of intra-articular injections were excluded.

After furnishing informed consent, all the patients had received viscosupplementation with HA gel in the clinic setting. High-molecular-weight highly crosslinked HA injection was then administered in the clinic setting using standard sterile aseptic techniques. Both the knee joints were prepped with 4% chlorhexidine surgical scrub solution and povidone solution, and the knees were draped with sterile sheets. Using the aseptic technique, the HA injection was administered.

Data was collected using a predesigned questionnaire, which included gender, age, KLS classification[14], follow-up date, follow up details, such as satisfaction level. WOMAC scores[15] were calculated at baseline and on their follow-up at 12 months. The WOMAC Index has its score distributed into 3 components: pain (score 0-20), stiffness (score 0-8) and physical function (score 0-68). Each component is evaluated on a five-point scale, ranging from none to extreme. Each component has further elements that are scored 0-4 for each element, with higher scores representing poor WOMAC scores[15].

Data was analysed using SPSS 23. Quantitative variables were reported as mean ± standard deviation or as median with interquartile range (IQR). Qualitative variables were reported as frequencies and percentages. Paired t-test and analysis of variance (ANOVA) were used as appropriate. $P<0.05$ was considered significant.

Results

Of the 180 patients with mean age 61.1+/-11.4 years, 109(60.6%) were females and 71(39.4%) were males. Overall HA injection ranged 1-3 doses. Of the total, 118(65.6%) patients received HA injections in bilateral knees, and 62(34.4%) in unilateral. There were 60(33.3%) patients who were classified as KLS grade II, 93(51.7%) as grade III and 27(15.0%) as grade IV (Table).

Table: Demographic characteristics of the patients (n=180).

Parameters	
Mean Age (Years)	61.1+/- 11.4
Gender	
Male	71 (39.4%)
Female	109 (60.6%)
Grade of Osteoarthritis	
II	60 (33.3)
III	93 (51.7)
IV	27 (15)

SD: Standrad deviation.

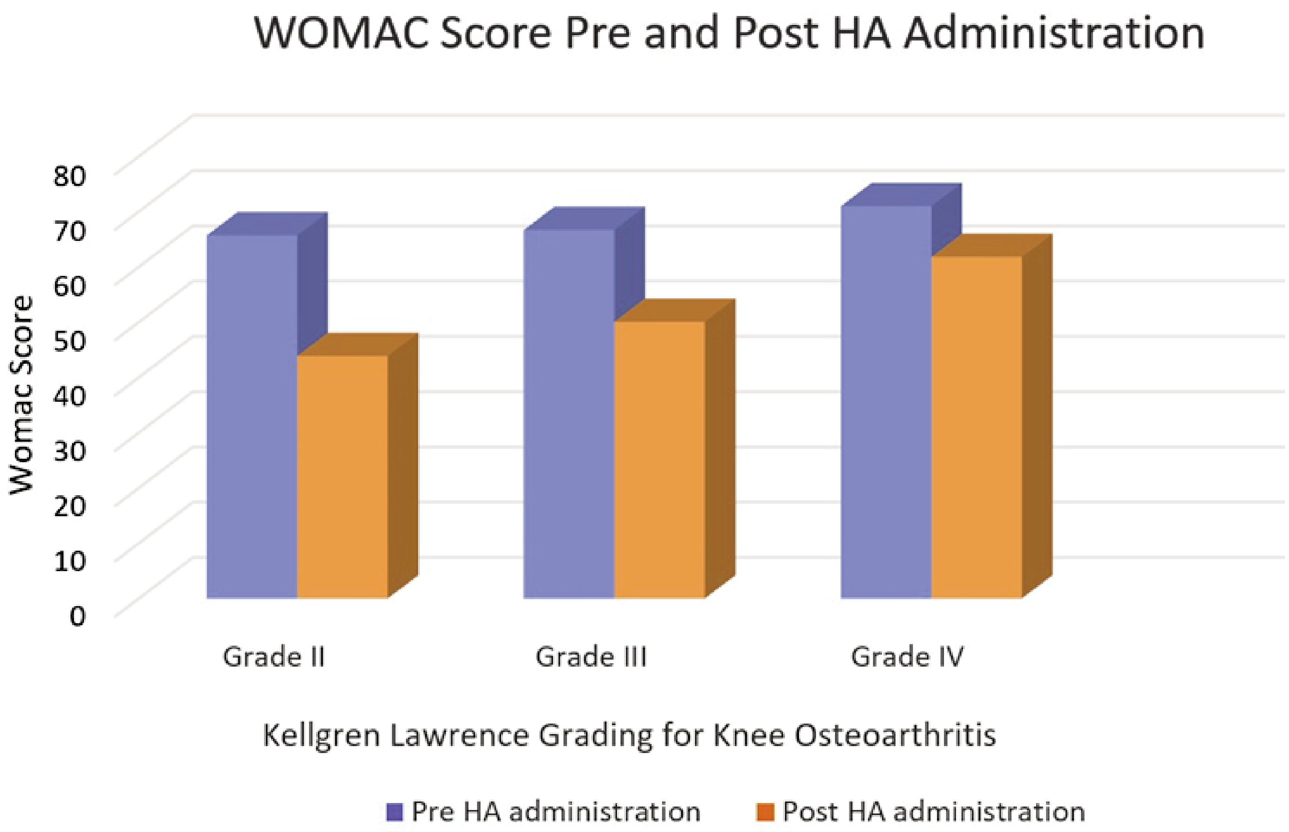

Figure: Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores at baseline compared to follow-up values

Mean baseline WOMAC score was 69.6+/-8.3 which went down to 48.2+/-10.6 post-intervention (p<0.005).

Mean baseline WOMAC score of KLS grade II patients was 65.7+/-8.3 which improved to 43.9+/-10.7 post-injection. KLS grade III patients showed improvement from 66.7+/-7.1 to 50.1+/-9.6. KLS grade IV patients showed improvement from 71.0+/-8.3 to 61.8+/-10.5 (Figure).

There were statistically significant post-injection WOMAC scores for KLS grade II, grade III and grade IV patients (p<0.05), but the improvement was better in grade II and III compared to grade IV (p<0.05).

Overall, 135(75%) patients said they were satisfied with the outcome, while 45(25.0%) patients were not satisfied. WOMAC score had no significant association with gender (p>0.05). There were no side-effects noted post-injection.

Discussion

OA is a progressive disease and the complete pathophysiology of its occurrence and progression is still not well understood. Hence, treatment options for OA majorly focus on alleviating the symptoms mainly related to pain and immobility, improving the QOL, and slowing down the progression of joint destruction.[16] OA can involve any synovial joint in the body, but it usually occurs in weight-bearing joints, like knees and hips.[17] In orthopaedic practice, intra-articular HA injections are commonly used now in the management of knee OA.[18] The current study was planned to examine the efficacy of intra-articular HA products, in particular the role of biocompatible gel implant produced from high-molecular-weight highly cross-linked HA in the management of knee OA.

In a study, the WOMAC score showed significant improvements after HA administration in the knee, improving from 43 to 23.[19] The current study showed an improvement from 69.6 to 48.2. A meta-analysis[20] concluded that intra-articular HA administration can decrease pain and function with or without activity. In another study, compared to placebo, HA was found to be more effective.[21]

The mean age of the current patients was 61.1±11.4 years, which is comparable to 67.2 reported earlier[19]. Female-to-male ratio was 60:39 was higher compared to 48:32 in a similar study.[19]

The current patients had no reactions to HA injection, which is considered safe even though it may show some benign local reactions as reported in a systematic review and meta-analysis of more than 8,000 patients.[22] The stabilisation process does not alter the biochemical characteristics of the exogenous HA, but it enhances the viscoelastic characteristics, and allows the HA preparation to remain in the joint for longer duration compared to preparations with non-stabilised HAs. This also helps in decreasing the number of doses required to attain the desired therapeutic results.[23]

The current outcomes revealed that the cross-linked HA administration had significant effectiveness in improving symptomatic knee OA, especially in patients with mild to moderate grade OA. A systemic review showed that repeated HA administration helps in improving the symptoms and duration of retention of HA in joints without increasing the risk of any serious adverse effects, demonstrating it as an additional benefit in knee OA because patients may need multiple doses of HA injection.[24]

It is believed that the clinically favourable effects of intra-articular HA in knee OA is due to various simultaneous mechanisms, rather than just one mechanism. Most of the extrinsic HA preparations stay in the synovial joints for a couple of days, but its beneficial effects may continue up to 6 months or longer. This may indicate that HA is not just productive in bringing back the viscoelasticity of the synovial fluid, but also has properties that may alter the disease process.[25]

Considering all the therapeutic options available for OA, visco-supplementation with HA injections is an extensively recognised and accepted method in clinical practice of orthopaedics.[17] The prevailing methods of OAmanagement, like the ones formed by the Osteoarthritis Research Society International (OARSI), consider HA as a secondary treatment option after a patient is unresponsive to other non-pharmacological and pharmacological methods, or for patients who do not respond well to analgesics, like NSAIDS, acetaminophen and opioids, or when these medications are contraindicated[26]. Alternatively, there are studies supporting the use of HA early in OA management. Patients in early stages and those with less severe symptoms showed marked improvement with HA than those in later stages of the disease. There is also evidence that people who receive HA early need lesser analgesics and other assistive devices. Conclusively, all this literature demonstrates that administration of HA early after diagnosis of OA could appreciably improve symptoms.[27]

The current study has limitations as it is a cross-sectional study and not a double-blind controlled trial, and the treatment method was not compared to other available pharmacological options. Besides, the lack of control group and and single-centre data may have affected the generalizability of the findings. Further, the sample size was not calculated as the study included data of all patients within the specified time duration. Finally, the WOMAC questionnaire[13] does not distinguish one knee from the other in patients with bilateral knee OA. Consequently, in patients where both knees were affected, the knee considered to have more severe symptoms by the patient was selected for treatment. Further research is recommended to validate the current findings and to explore the long-term benefits of the intervention.

Conclusion

Viscosupplementation with HA significantly improved outcomes for patients with knee OA over a one-year follow-up period, indicating a reduction in pain and enhancement in mobility. These benefits were especially pronounced in patients with mild to moderate OA, suggesting that intra-articular HA injections could be an effective treatment option.

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Conflict of Interest: None.

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