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PREVALENCE OF MORTON'S NEUROMA AND ITS ASSOCIATION WITH PAIN AND DISABILITY AMONG SALESGIRLS WEARING HIGH HEELS

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ABSTRACT

Background: *Morton's neuroma is a painful condition that affects the ball of foot results in severe pain and causes difficulty in walking. Wearing high heel, center of gravity of body shifts forward, decreases base of support on the weight-bearing foot, metatarsophalangeal joint moves into hyper-extension, and nerve compresses between metatarsal heads, resulting in neuroma.*

Objectives: *The aims and objectives of our study were to evaluate the prevalence of Morton's neuroma and its association with pain and disability among Sales Girls wearing high heels.*

Methodology: *A cross-sectional study was conducted on sales girls wearing high heels (n=98) from different shopping malls in Faisalabad. A 12 weeks study from February 2024 to June 2024 after approval of synopsis (IRB ref no# TUF/IRB/400/24). A convenient sampling technique was used to collect the sample size. After obtaining informed consent from the participants, screening was done by screening tool. The Thumb Index Finger Squeeze test and a screening tool based on inclusion and exclusion criteria were used to screen the study population. The study comprised sales girls between the ages of 20 and 35 who had worn high heels for at least four hours a week, for at least a year, with a minimum heel height of 5 cm or more, and who were willing to participate. With SPSS version 20, statistical analysis was carried out.*

Result: *The research finding demonstrates 59.18% prevalence of Morton's neuroma among sales girls wearing high heels with the experience of moderate level associated with pain and disability.*

Conclusion*: It was concluded that prevalence of Morton's Neuroma among sales girls wearing high heels was high. The findings showed that high heels were significantly associated with the prevalence of Morton's Neuroma.*

Keywords: *Prevalence, Morton's neuroma, pain, disability, high heels, Thumb index finger squeeze test*

INTRODUCTION

Morton's neuroma is a painful condition that affects the ball of foot and results in severe pain and causes difficulty to walk. The term "neuroma" represents tumor of the nerve. On the basis of size, shape and structure of tissues when observed under a microscope, the term neuroma also suggested as end neural-edema, neuro-fibroma angio-neurofibroma and local vascular degeneration (1). According to Nissen, weight-bearing causes excessive micro-trauma to the structures which leads to vascular occlusion and degeneration of nerves and causes Morton's neuroma. Morton's neuroma presents as a fusiform swelling and on surgical removal, it presents as white yellowish glittering appearance (2). Morton's neuroma can also appear as peanut or dumbbell-shaped lumps near the metatarsal heads in Interdigital spaces close to transverse inter-metatarsal ligament when seen on coronal images (3).

According to some studies, it can be associated with hypermobility of metatarsals or repetitive motions which compress bundles of nerves between them. Some evidences proposed that crush injuries and activities where compressive forces strikes the metatarsals of foot and causes impingement of nerves and lesion formation. Anatomical misalignment and mechanical deformities may also contribute to the development of symptomatic Morton's neuroma (4). Medial and lateral planter nerves gives off common plantar digital nerves which runs in Interdigital spaces close to inter-metatarsal ligaments. Third digital branch receives large connecting branch from lateral plantar nerve and proceeds deep to transverse metatarsal ligament (5). In Morton's neuroma, third inter-digital nerve is frequently more prone to damage, less frequently affected is second inter-digital nerve and rarely affected is first and fourth inter-digital nerves (6). Morton's neuroma can also be identified as Interdigital neuroma, Interdigital neuritis, Inter-digital metatarsalgia or Morton's metatarsalgia (5).

Anatomical consideration is that third inter-digital nerve passes from narrowest space deep to the transverse metatarsal ligament, so nerve is less mobile there during weight bearing activities. It is also proposed that the third inter-digital nerve is formed by anastomosis of two nerve trunks which makes it thicker than other nerves and makes it vulnerable to lesion (7). It is generally affecting the middle-aged women but there are very little studies on its frequency (8). The chances of Morton's neuroma are 10 times higher in females than in males (5). High-heeled shoes exert pressure on the edges of metatarsal bones, which compresses the bones and squeezes the nerve between them (9). Wearing high heel increases center of gravity of body, decreases base of support on the weight-bearing foot, metatarsophalangeal joint moves into hyper-extension, nerve moves against transverse inter-metatarsal ligament and compress between metatarsal heads, resulting in neuroma (6).

Many researchers registered the harmful effects of high-heeled shoes that involve injured leg muscles and low back pain which is linked to abnormal posture. If a woman regularly wears such physiologically unfit shoes which induce cumulative damage to foot, she could be setting an environment for herself for one of these foot problems (9).

High heeled shoes are defined as where the heel of foot is higher than forefoot and heel elevation is more than 5cm (10). A high-heeled shoe includes narrow toe box, curved plantar region and a rigid heel cap which affects the motion of foot in the shoe and leads to many biomechanical changes. Despite its numerous cautions, these are constantly being used by a large amount of women population all around the world (11).

According to the historical background, it is stated that women started to wear high-heeled shoes to satisfy their desire to look more attractive and beautiful despite of their negative side effects (12). It is proved that women wearing high-heeled shoes look more attractive and younger than women wearing flat shoes. As a result in many disciplines, wearing high heels have become part of female uniforms (13).

Morton's neuroma was firstly described by Civinini in 1835 as painful lesion of inter-digital nerve of third inter-metatarsal space (14). In 1940, Betts, introduced the word "neuroma" and compression of plantar nerve below inter-metatarsal ligament (7). Later on, in 1876 an American orthopedic surgeon, Thomas Morton, further described the term and now this condition bears His name (14).

Pain associated with Morton's neuroma is occasionally confined between third and fourth toe and increases on weight bearing activities like walking and running (15). Excessive movement or stress to foot causes pain between metatarsal heads and radiates towards the tip of toes. It results in shooting pain between adjacent Interdigital spaces including sharp and burning sensations that worsen by wearing high heeled shoes, feels like walking with a pebble in the shoe and weight bearing results in paresthesia (1). Pain can even radiate towards the dorsal aspect of foot and in lower leg (6). Patients whose job is long driving also explain that symptoms of pain worsen when affected foot is controlling the pedal of the car (15).

Morton's neuroma is more frequent cause of forefoot pain which differentially diagnosed with tarsal tunnel syndrome, lumbar radiculopathy, peripheral neuritis and neuropathy, soft tissue tumors of forefoot and painful planter callosity which is associated with hammer toes and claws toes (6). While according to some studies it can also be differently diagnosed with inflamed metatarsal bursa, metatarsophalangeal joint instability, collateral ligament tears, and pericapsular fibrosis. It is because these conditions are presented with same clinical symptoms as in Morton's neuroma like forefoot pain, numbness, tingling sensations, pain during walking and feels like walking on stones (3).

MATERIALS AND METHODS

A cross sectional study was conducted to evaluate the Morton's Neuroma prevalence, associated with pain and disability among sales girls wearing high-heeled shoes through a survey. A 12-week study from February 2024 to June 2024 after approval of synopsis (IRB ref no# TUF/IRB/400/24). The study setting was the Shopping Malls of Faisalabad. The study duration of this study was 4 months after approval of synopsis. The study population included sales girls wearing high heeled shoes. The sample size was 98 calculated through Fisher's formula. The sampling technique was convenient sampling. The screening of study population was done by Thumb Index Finger Squeeze test and by screening form. The participants were included of age 20 to 35 years, sales girls who wore high heeled shoes for at least 4 times a week for 4 consecutive hours, Wearing high heeled shoes of minimum 1 year, Heel length of 5cm or higher (16). The participants were excluded with history of fracture and trauma of foot, history of surgery of foot, deformity of metatarsophalangeal joint, degenerative disorder of foot e.g. osteoarthritis, Rheumatic Disorder e.g. rheumatoid arthritis, ankyloses, spondylitis, Toe/Foot deformity e.g. claw toe, hammer toe, mallet toe, Neurological Disorders e.g. peripheral neuropathy (16). A signed informed consent was attained from the participants before enrollment into the study. Foot Function Index is a questionnaire which is used to evaluate the impact of foot disability and pain by dividing into three sub-scales: pain, disability and activity restriction. The score was determined by using a numeric rating scale which ranges from 0 to 10 with higher scores reveal greater impact of foot pain and disability (17). The screening of study population was done by Thumb Index Finger Squeeze Test. At, first data was collected from sales girls wearing high heeled shoes in shopping malls of Faisalabad. Participants were recruited based on predetermined inclusion and exclusion criteria. Consent was taken from each participant. Thumb index finer squeeze test was applied to diagnose the Morton's Neuroma and then data was taken by questionnaire i.e. Foot Function Index (FFI). Statistical Analysis was performed by using SPSS version 20 software.

RESULT:

A cross-sectional study conducted on 98 sales girls wearing high heels. Foot Function Index is a questionnaire which is used to evaluate the impact of foot disability and pain by dividing into three sub-scales: pain, disability and activity restriction. The score was determined by using a numeric rating scale which ranges from 0 to 10 with higher scores reveal greater impact of foot pain and disability

Table: 1 Assessment by Thumb Index Finger Squeeze Test:

59.18% salesgirls have positive thumb index finger squeeze test and 40.82% have negative test. The result of total prevalence of morton's neuroma was anlysed by frequency distribution according to result out of 98 participants, 59.18% participants were diagnosed with Morton's neuroma while 40.82% participants did not have Morton's neuroma.

(Figure 1)

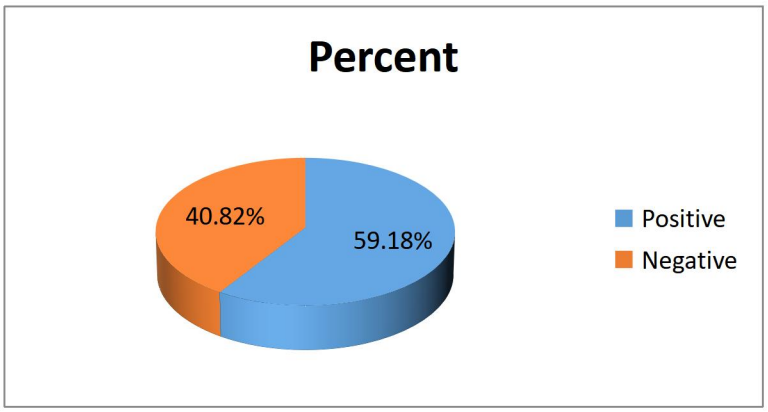

Figure 1: Thumb Index Finger Squeeze Test

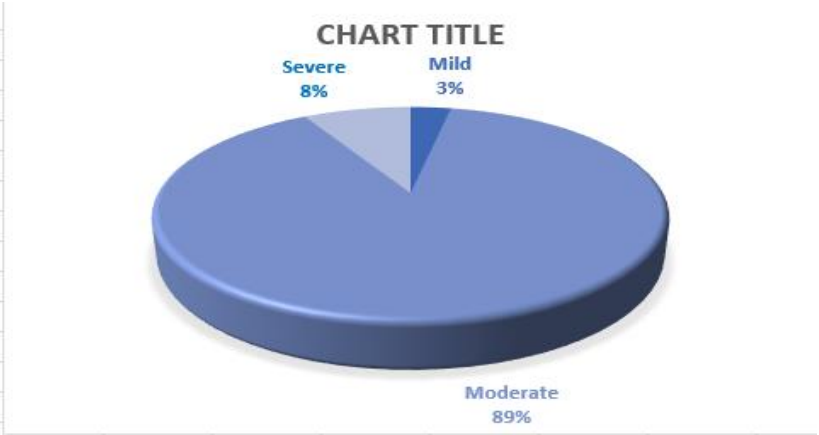

Figure: 2 Analysis of Pain Scale of FFI:

The above graph of pain scale of FFI shows that 3% of participants have mild range of pain, 88% of participants have moderate range of pain and 9% of participants have severe range of pain.

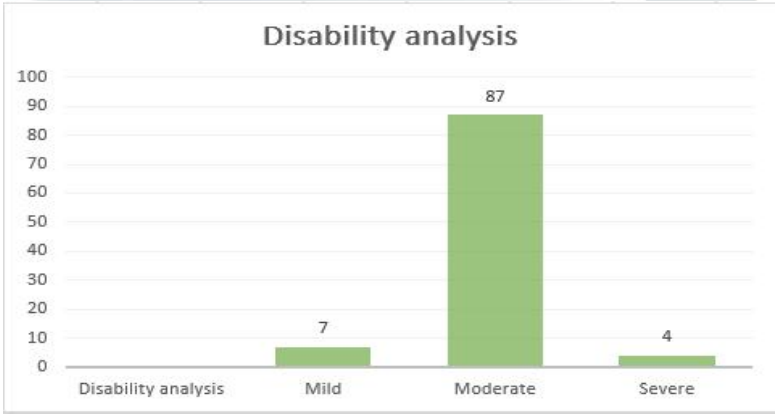

Figure: 3 Analysis of Disability Scale of FFI:

The above graph of disability scale of FFI showed that 7% of participants have mild level of disability, 87% of participants have moderate level of disability and 4% of participants have high level of disability. Total FFI score analysis was done by descriptive stat analyses whereby mean was 81.8469±16.16880

Table: 1 Association between pain and level of disability in females wearing high heel

Chi-square test	p-value
Association between level of pain in females wearing high heels	**0.006**
Association between level of disability and females wearing high heels	**0.011**

The chi square test shows the P value is < 0.05. So, there was a significant association between pain and level of disability in females wearing high heel.

Discussion

Morton's neuroma is a prevailing source of pain in forefoot. It hampers regular daily activities and induces discomfort and impairment for individuals affected by it. Thus in our study we investigate the prevalence of Morton's neuroma as well as its association with pain and disability among salesgirls wearing high heels.

Our study emphasizes the impact of Morton's neuroma on overall pain and disability and work productivity of salesgirls wearing high heels. Comparing the results with the previous researches, several studies highlighted that the condition leads to significant pain and discomfort due to high heels, which can impair their ability to perform daily activities and occupational duties effectively.

Hazem HASSOUNA, Diashan SINGH conducted a research in Royal National Orthopaedic Hospital, Stanmore, United Kingdom, which showed that Morton's neuroma is more prevalent in females (78% to 95%). This study proved that wearing high heels puts pressure on metatarsal heads which cause compression, stretching and tethering of Interdigital nerves, which concluded the high risk of Morton's neuroma among this population. The study was conducted by Kent K. Wu MD in Henry Ford Hospital which showed that pointed and high heeled shoes are harmful to the third common Interdigital nerve by putting compression to all the metatarsal heads and this leads to Morton's neuroma. Thus their findings align with our results suggested that the participants wearing high heels are more likely to have Morton's neuroma.s

Pain assessment is assessed by FFI. Participants with negative thumb index finger squeeze test 5% have mild pain, 90% have moderate pain and 5% have severe pain. On the other hand participants with positive thumb index finger squeeze test 2% have mild pain, 88% have moderate pan and 10% have severe pain. Owing to disability, participants with negative thumb index finger squeeze test, 5% have mild level of disability, 93% have moderate level of disability and 2% have high level of disability. On the other hand, participants with positive thumb index finger squeeze test 9% have mild level of disability, 86% have moderate level of disability and 5% have high level of disability. Thumb index finger squeeze test is used in our study to check the positive and negative impact of pain on foot and also for the result interpretation.

The result shows that p value is <0.05, which indicates the association of pain and disability with high heels among salesgirls. This shows the increased risk of Morton's neuroma among salesgirls due to high heels.

At last the conclusion, research findings shows the 59.18% prevalence of Morton's neuroma and its association with pain and disability among salesgirls wearing high heels. It indicates the need for early intervention and preventive measures.

Limitations of study:

The limitations of the study are as follows:

- The study has a relatively small sample size, limiting the generalizability of findings.
- Due to busy routine, participant's cooperation was poor.
- Some shopping centers did not allow the survey.
- Gait assessment was not done although detail history was taken from them.
- Sales girls having surgery, arthritis and disorders of foot were not taken into account for this study.
- The duration of study was 4 months, which may have been relatively small duration of time to complete research.

Conclusion

In conclusion prevalence of Morton's Neuroma in association with pain and disability among sales girls wearing high heels found high. The findings showed that high heels were significantly associated with occurrence of Morton's Neuroma. According to the study, 59.18% of Sales Girls were suffering from Morton's Neuroma and have a mean value lies in the category of moderate pain and moderate disability but not severe association with high heels and Morton's Neuroma among Sales Girls.

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