Effects of Therapeutic Weight Loss Exercises on Obese Indivduals with Genu Valgum Deformity

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Abstract

Introduction: Obesity is a major factor, increasing susceptibility for MSDs, specifically thereof lower back and lower extremities. An increase in Q angle beyond the normal range is known as genu valgum (knock knees) and considered as extensor mechanism misalignment, and it has been associated with knee joint hypermobility, patellar instability and patellofemoral pain syndrome. the association with increased BMI and genu valgum and found that the severity of tibia vara was high obesity.

Material and Methods : The interventional study was conducted in a Physiotherapy centre with 50 overweight and obese males with increased Q-angle between the age group of 25-40 years. Recent fractures, open wounds, and other congenital anomalies in the lower extremities were excluded. Therapeutic weight loss exercises were given based on the American college of sports medicine (ACSM) and the observations were done.

Results: Pre and post intervention results showed a significant ($p < 0.005$) that the treatment given was effective.

Conclusion : In conclusion, the severity of the genu valgum is directly associated with increase in BMI, sedentary lifestyle and physical inactivity plays a major etiological role for obesity in the development and progression of genu valgum. Essentially, early detection and intervention with guidance of physical therapist can correct the deformity with limited surgical morbidity.

***Key words :** Q-angle, Weight loss exercises, Genu valgum, Obesity and genu valgum*

Introduction

Obesity is one of the metabolic disorder in which there is an accumulation of excessive fat that have a negative effect on health [1]. The World Health Organization reported that more than one billion people are overweight and of these, 300 million are obese worldwide [2]. Although the mortality rate is low in musculoskeletal disease, it is a major cause of pain and disability in the society[3]. Musculo-skeletal disorders (MSDs) are caused by increased stress to the skeletal system through biomechanical load which may be caused by occupation (external load) or obesity (internal load) [4]. Stated that obesity is a major factor, increasing susceptibility for MSDs, specifically thereof lower back and lower extremities[5]. Done a literature review of 63 research papers and observed that obesity has been clinically implicated with musculoskeletal disorders involving the back, osteoarthritis of hip, knee, flattening of the medial longitudinal arch and chronic heel pain[6]. Conducted a cross-sectional study using a tool "Nordic Musculoskeletal Questionnaire" among 41 subjects with the mean age of 40.78 ± 9.85 years and the mean BMI

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(46.87 ± 8.08) and found that 80.49% of the individuals marked the painful areas as ankle feet, lower back, knees, wrists, hands and fingers[7].

A retrospective review of relationship was done between genu valgum and obesity with the existing data on 66 children with mean age 12.2±2.2 years and found that 71% obese children had genu valgum, he concluded that obesity may play a role in the etiology of idiopathic genu valgum in young age and leads to osteoarthritis during old age [8]. The normal range of Q angle is $14^0$for males and 17^0 for females [9, 10, 11]. An increase in Q angle beyond the normal range is known as genu valgum (knock knees) and considered as extensor mechanism misalignment, and it has been associated with knee joint hypermobility, patellar instability and patellofemoral pain syndrome [12, 13]. The Q-angle is one of the major predictor of knee problems and lower limb injuries[14]. Abnormally increased Q-angles (> 15° for males and 20° for females) are considered to be an anatomical risk factor in the etiology of overuse injuries of the knee. Q angle may increase in conditions such as increased femoral anteversion, external tibial torsion, laterally positioned tibial tuberosity, tight lateral retinaculum[15].The physical inactivity is a predisposing factor for obesity which leads to idiopathic genu valgum in children 3 to 9 years of age[16]. demonstrated the association with increased BMI and genu valgum and found that the severity of tibia vara was high obesity[17].

From the problem stated it has been showed that obesity is one of the predisposing factor in developing the genu valgum, literature has shown that surgical methods have been implicated for the correction of deformity, but none of the studies have been reported to correct the genu valgum deformity by conservative method among obese individuals. There is a lacuna in reporting the effects of therapeutic exercises over the genu valgum, hence the aim of our present study was to find the effects of weight loss exercises among the obese individuals with genu valgum deformity.

Study design

The interventional study was conducted in a Physiotherapy centre at Chennai. A total number of 50 overweight and obese males with increased Q-angle between the age group of 25-40 years with a Mean height of 173(cm) and weight of 98.61(Kg) met the selection criteria were enrolled in this study. Recent fractures, open wounds, and other congenital anomalies in the

lower extremities, uncontrolled hypertension (systolic blood pressure > 180 mm Hg or diastolic blood pressure > 100 mmHg) and other cardiovascular diseases, or any major active rheumatologic, pulmonary, hepatic, renal, dermatologic disease or inflammatory conditions were excluded. Written consent form was obtained from the patients after detailed explanation of the study, their role, risks & benefits involved and their rights. The study was approved by the institutional ethical committee (IEC)

Materials

The materials used were

- Standard height and weight measuring scale.
- Goniometer to measure the Q-angle.
- Fitness equipments (stationary cycle, treadmill, dumbbells, barbells, resistance band)

Procedure

The individuals underwent a Health-related physical fitness tests and assessment according to the guidelines provided by the American College of Sports Medicine (ACSM) [18]. Height and weight of the individuals was measured using a standard scale. BMI was calculated by Wt/Ht $(mt)^2$. Q-angle was measured by a line drawn from the anterior superior iliac spine (ASIS) to central patella and a second line drawn from central patella to tibial tubercle [19]. Weight reduction exercises and healthy diet patterns for weight loss [20] were given to the individuals, appropriately for 1 year duration. The exercises were listed in table: 1, the intensity of the exercises was increased based on the performance and improvement. The parameters were recorded before and after the intervention.

Table 1 : Exercise schedule given for weight loss

Warm up exercises 5-10mins					
Flexibility training for all the major muscles					
Cardiovascular training 45-60mins					
Core and abdominal exercises					
Strength training					
Exercises		Sets	Reps	Tempo	Rest
Day 1	Thighs and legs	2-3	15,12,10	2:01:04	30-45(sec)
Day 2	Latissmus dorsi and biceps	2-3	15,12,10	2:01:04	30-45(sec)
Day 3	Chest and triceps	2-3	15,12,10	2:01:04	30-45(sec)
Day 4	Shoulders and neck	2-3	15,12,10	2:01:04	30-45(sec)
Day 5	Upper and lower back	2-3	15,12,10	2:01:04	30-45(sec)

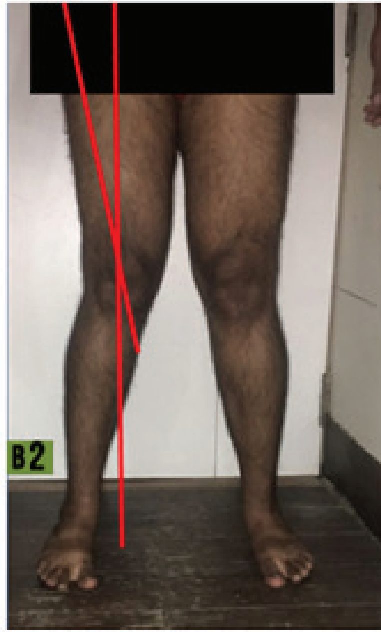
Observation and Results

Table 2: Statistical analysis of parameters pre and post intervention

S.no	Parameters	Pre Mean (SD)	Post Mean (SD)	t	p-value	CI
1	Weight (Kg)	98.61(23.7)	86.33(16.4)	12.76	<0.001	95%
2	BMI (Kg/m2)	35.42(7.46)	31.16(5.59)	13.37	<0.001	95%
3	Q-angle (degrees)	16.2(2.7)	15.4(1.9)	4.70	<0.001	95%

p-value < 0.005 = statistically significant, Confidence interval – (CI) 95%

The weight loss exercises administered for the obese individuals resulted in significant reduction of weight and BMI (Mean Difference of 12.28(9.6) Kg and BMI 4.26(3.2) Kg/m^2 respectively. The Q angle also recorded significant reduction of 1.2(1.19) degrees with a 95% CI of 0.86-0.54 in the Q-angle as shown in table 2.



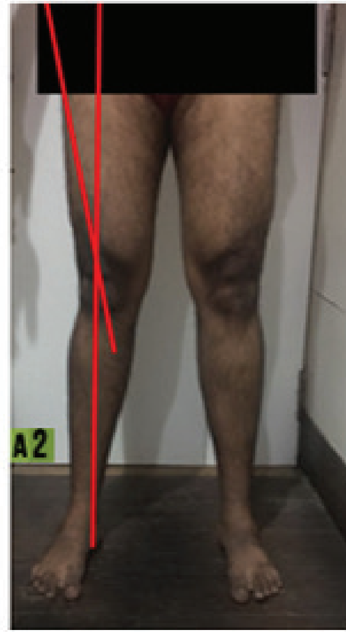


Figure: 1
Q – angle before intervention

Figure: 2
Q – angle after intervention

Discussion

Obesity causes metabolic disorder and also had negative effects over musculo-skeletal system, but we have focused only on the effects of weight loss on exercises on Q-angle, this is the limitation of the study. The study results demonstrate that overweight and obese participants showed increase in Q-angle which caused a genu valgum deformity, with the prescribed weight loss and strengthening exercises the participants showed significant changes in Q-angle.

The line of gravity (LOG) is an imaginary line passing vertical through the centre of gravity (COG) from the vertex of the head to the foot, there is a structural and functional connection (kinetic and kinematic chain) between the trunk and lower extremity which operates the biomechanics of the lower extremities. In individuals with ideal body weight, the weight is transferred through the spine to the pelvis; from pelvis, the force is transmitted to the lower extremities [21]. This biomechanical sequence of weight distribution was affected in obesity due to abnormal alteration in the Q-angle. Obesity caused an increase in the Q-angle by placing a excessive stress over the femoral condyles thus internal femoral torsion which leads to a muscle imbalance between the vastus medialis and vastus lateralis. This abnormal alteration reduces the efficiency of the quadriceps muscle and cause the deviation of patella with genu valgum deformity. In the present study this patho-mechanical alteration was reversed by the weight loss and strengthening exercises. Weight loss exercises with diet patterns showed a significant weight loss of Mean difference 12.28(9.6) Kg and BMI 4.26(3.2) Kg/m^2 the given strengthening exercises provided stability for the trunk and pelvis in the post intervention, the changes in the appearance of anterior part of the thigh muscle with reduction in the Q-angle was shown in figure 1 & 2.

Orthotic Special shoes are ineffective in treatment or prevention of genu valgum, as they do not correct the genu valgum but relieve muscle fatigue, foot strain, and calf muscle pain[22]. Performed hemiepiphysiodesis technique by stapling the medial part of the distal femoral and proximal tibial growth plates, and concluded that this surgical procedure may end up with undercorrection or overcorrection[23]. Done a surgical procedure in 48 obese children between the age group of 12.7±6.76 years with genu valgum by means of temporary hemiepiphysiodesis using eight-plates and revealed that temporary hemiepiphysiodesis technique using eight-Plates is a

simple, gentle, and effective procedure to treat genu valgum[24]. When comparing the treatment technique of stevens PM & Walker et al the surgical technique for genu valgum may end up with complications. In contrast to this the aim of the present study focussed on the conservative and therapeutic management. Positive changes have been observed in the Q angle after the post intervention therapy with a significant value of 1.2(1.19) degrees with a 95% CI of 0.86-0.54 as shown in table 2. This showed that obese individuals have a similar positive association for genu valgum with the reduction of magnitude of valgus in the tibia.

Conclusion

In conclusion, the severity of the genu valgum is directly associated with increase in BMI, sedentary lifestyle and physical inactivity plays a major etiological role for obesity in the development and progression of genu valgum. Obesity and lower extremity malalignment are high risk factors for the development of osteoarthritis of the knee and ankle in adults. Regular exercises with healthy diet patterns minimize the valgus deformity in obese individuals and be expected to reduce the risk of osteoarthritis associated with limb malalignment and reduce the need for joint replacement in the future. Essentially, early detection and intervention with guidance of physical therapist can correct the deformity with limited surgical morbidity.

Ethical Clearance: The study was approved the institutional ethics committee (IEC)

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Conflict of Interest: Nil

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