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Original Research Article

Varus Thrust in Osteoarthritis Knee

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Abstract: Osteoarthritis is a degenerative joint disease involving the cartilage and many of its surrounding tissues. In addition to damage and loss of articular cartilage, there is remodeling of subarticular bone, osteophyte formation, ligamentous laxity, weakening of periarticular muscles, and, in some cases, synovial inflammation. These changes may occur as a result of an imbalance in the equilibrium between the breakdown and repair of joint tissue. Current treatments may improve symptoms but do not delay disease progression. So the prevention of knee osteoarthritis should be one of the major aims of health care, and requires clear knowledge of the risk factors of the disease. Many investigators have previously reported a variety of risk factors for knee osteoarthritis. However, relatively few have studied diseases progression longitudinally. 60 patients with OA knee were included and studied in terms of occupation, BMI, Co-morbidity, varus alignment, WOMAC score, Chair stand rate, Kellgren and Lawrence radiological grade, varus thrust and their longitudinal progression were studied over next 3 years. It was found that the patients with varus thrust during walking had rapid progression than patients with out varus thrust. Hence we concluded that the progression of OA can be reduced by preventing varus thrust.
Keywords: Varus thrust, osteoarthritis knee, Body Mass Index, Varus alignment, WOMAC score, Chair stand rate, Kellgren and Lawrence radiological grade.

INTRODUCTION:

Osteoarthritis is a degenerative joint disease involving the cartilage and many of its surrounding tissues. In addition to damage and loss of articular cartilage, there is remodeling of subarticular bone, osteophyte formation, ligamentous laxity, weakening of periarticular muscles, and, in some cases, synovial inflammation [1]. These changes may occur as a result of an imbalance in the equilibrium between the breakdown and repair of joint tissue. Knee osteoarthritis is more common in India as compare to rest of the World. Knee osteoarthritis (OA), a leading cause of functional limitation and disability in older persons, is believed to result from local mechanical factors acting within the context of a systemic susceptibility[2]. Primary symptoms of osteoarthritis include joint pain, stiffness and limitation of movement. Disease progression is usually slow but can ultimately lead to joint failure with pain and disability. Many investigators have previously reported a variety of risk factors for knee osteoarthritis. However, relatively few have studied diseases progression longitudinally. It is now recognized that risk factors for the development of osteoarthritis are different from those of progression. Cooper et al[3]suggested that prevention of the progression of osteoarthritis to severe damage is a more effective public health strategy, than attempting to prevent the initial development of the disease. Current treatments may improve symptoms but do not delay disease progression. Factors that contribute to osteoarthritis progression may represent targets for novel disease modifying interventions. Increased joint loading is theorized to play a key role in the progression of knee osteoarthritis, but few specific mechanical factors have been identified [4]. Varus alignment (hip–knee–ankle angle of 0° in the varus direction) is a static measurement assessed in the standing position using full-limb radiography. In contrast, varus thrust is the visualized dynamic bowing-out of the knee laterally, i.e., the abrupt first appearance of varus (or the abrupt

worsening of existing varus) while the limb is bearing weight during ambulation, with return to a less varus alignment during the non–weight-bearing (swing) phase of gait. Aim of this study was to observe the effect of varus thrust on clinico-radiological progression of osteoarthritis knee joint.

METHODS AND MATERIAL:

Study design: This prospective observational study was conducted between August 2012 to Sept 2014. 60 patient (120 knees) with age above 50 yrs and primary OA knee grade ≥ II by Kellgren/Lawrence grading were included in the study. Written informed consent of the patient was obtained after explaining about the study. Detailed history of each patient was taken, regarding the onset, duration and progress of complain like pain, swelling, disability, Co-morbid condition. Past history of infection of joint and prolonged drugs intake was inquired. Height (cm) and weight (kg) was recorded in all the cases. Examination of Knee was done in all the cases that included tenderness, deformity and knee range of motion. Standing varus and valgus malalignment was measured by physical examination in accordance with a carefully detailed protocol specifying the following: participants foot position , knee position in double leg stance and weight distribution; land mark for long arm goniometer placement and standardized reading and measurement procedure.

Knee radiographs were acquired using a" fixed flexion" knee radiographs protocol including bilateral , standing , posterio-anterior knee films with knees flexed to 20-30 degree and feet internally rotated 10 degree using a plexiglass positioning frame. Right and left knees where imagined together on 14 x 17 inch film using focus-to-film distance of 72 inches. Kellgren – Lawrence grading score was recorded for all the patients (I-IV) .The functional outcome was assessed at the baseline and at the end of follow up(9 months). Chair- stand performance (rate of chair stands per minute, based on the time required to complete 5 repetition of rising from a chair and sitting using down) the sit-stand transfer is closely linked to knee status Subjective assessment of knee function was done using modified WOMAC score. Each participant was assessed for the presence of the varus thrust during walking. Observation of gait for the presence of thrust was performed in a single unit and walkway, following a protocol that standardized the instruction given to the participant and the position and step for the examiner. To assess intrarater reliability , it was not possible to use the live observation of gait, because the examiner may remember the presence or absence of thrust in specific individual. Therefore we videotaped the gait of all the participants and the identity was concealed. Each examiner viewed the videotapes during 2 separate sessions, at each order of tapes had been altered , revealing very good intrarater reliability (K=0.81) .The participants were classified into two groups depending upon the presence of varus thrust during walking. Assessment was done to see whether the presence of varus thrust increases symptoms in presence of varus deformity. The information was noted in the attached Performa Each patient would be followed up to the 9 months . Physical , functional , radiological assessment was done at 9 months. Gait is again analyses to see the varus thrust at 9 months follow up.

Statistical analysis was done using IBM SPSS Version 17 software on window 7. Variable were categorized in the scale, nominal and ordinal. The mean were compared using paired student t- test or independent t- test depending on the distribution of samples. The proportions were analyzed using Binomial and Chi Square Test. Correlation of proportion were established using Pearson Correlation formula.

RESULTS:

Table-1 shows Comparison of WOMAC score showed mean 7.1 increases at 9 months follow up. WOMAC score at baseline and at 9 months follow up was statistically significant. (P value 0.000; $p<0.05$).

Table-2 shows the comparison of mean of chair stand rate showed mean 1.95 decreases at 9 months follow up. Comparison of chair stand rate at baseline and after 9 months follow up was statistically significant.(p value 0.00; $p<0.05$)

Table-3 shows 8 patients were recorded in grade 4 at the end of 9 months follow up where as baseline no was 2. Grade 3 patient were 24 at baseline and 22 at 9 months follow up. Grade 2 patients were 34 at baseline and 30 at 9 months follow up.

Table-4 shows the proportion of the patients in various K-L grade at baseline and 9 months follow up was analyzed. The difference in proportion was significant statistically.

Table-5 shows the Mean BMI of patient with varus thrust was 23.605 while without varus thrust was 21.573. Mean Fixed flexion deformity of patient with varus thrust was 11.05 where as without varus thrust was 1.71. Mean WOMAC score at baseline in patient with varus thrust was 64.53 while without varus thrust was 49.76. Mean chair stand rate of patient with varus thrust was 12.42 while without varus thrust was 19.10.

Table-6 shows the Mean of all the clinical parameters in patients had varus thrust present and absent were analyzed using independent 't' test. The mean of BMI and flexion deformity were compared and found statistically insignificant where as means of WOMAC score at baseline , Chair stand rate , and

WOMAC at 9 months follow up was found to be statistically significant.

Fig-1 shows at baseline 19 Patients showed varus thrust and 41 without thrust. At 9 months follow up 22 showed varus thrust while 38 without varus thrust.

Table-7 shows the proportion of patient with varus thrust at baseline and at 9 months of follow up were compared and was found to be statistically significant. (p value 0.039; p< 0.05)

Table 1 : Comparison of WOMAC score at baseline and after 9 months follow up

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	WOMAC	54.43	60	10.649	1.375
	WOMAC after 9 months	61.53	60	12.565	1.622

		N	Correlation	Sig.
Pair 1	WOMAC & WOMAC after 9 months	60	.956	P=0.000

Table 2: Comparison of chair stand rate at baseline and at follow up of 9 months in patients.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	chair stand rate/min	16.98	60	4.478	.578
	chair stand rate after 9 months	14.73	60	5.602	.723

Paired 't' test			
	t	df	Sig. (2-tailed)
chair stand rate/min at base line x chair stand rate after 9 months	9.041	59	P=0.000

Table 3: Comparison of K-L radiological grading at baseline and at 9 months follow up

		KL 9 Months			Total
		Grade II	Grade III	Grade IV	
K L Grade	Grade II	30	4	0	34
	Grade III	0	18	6	24
	Grade IV	0	0	2	2
Total		30	22	8	60

Table 4: Correlation of K-L grading score at baseline and 9 months follow up

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.293[a]	4	0.000
Likelihood Ratio	66.350	4	
Linear-by-Linear Association	42.760	1	

Table 5 : Descriptive analysis of varus thrust with other clinical parameter.

Group Statistics					
	Varus Thurst	N	Mean	Std. Deviation	Std. Error Mean
Body Mass Index	Present	19	23.605	3.2257	0.7400
	Absent	41	21.573	2.3166	0.3618
FFD	Present	19	11.05	5.671	1.301
	Absent	41	1.71	3.809	0.595
WOMAC Baseline	Present	19	64.53	4.730	1.085
	Absent	41	49.76	9.295	1.452
Chair Stand Rate	Present	19	12.42	1.953	0.448
	Absent	41	19.10	3.659	0.571
WOMAC at 9 months	Present	19	74.00	5.121	1.175
	Absent	41	55.76	10.632	1.660

Table 6: Correlation of varus thrust with other clinical parameters.

	Levene's Test for Equality of Variances								
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Body Mass Index	3.373	.071	2.781	58	.007	2.0321	.7306	.5696	3.4945
			2.467	26.940	.020	2.0321	.8237	.3418	3.7224
FFD	.012	.912	7.531	58	.000	9.345	1.241	6.862	11.829
			6.532	25.847	.000	9.345	1.431	6.403	12.287
WOMAC Baseline	6.295	.015	6.525	58	.000	14.770	2.264	10.239	19.301
			8.150	57.378	.000	14.770	1.812	11.142	18.399
Chair Stand Rate	8.944	.004	-7.453	58	.000	-6.677	.896	-8.470	-4.883
			-9.195	56.693	.000	-6.677	.726	-8.131	-5.222
WOMAC at 9 months	12.268	.001	7.085	58	.000	18.244	2.575	13.089	23.399
			8.969	57.854	.000	18.244	2.034	14.172	22.316

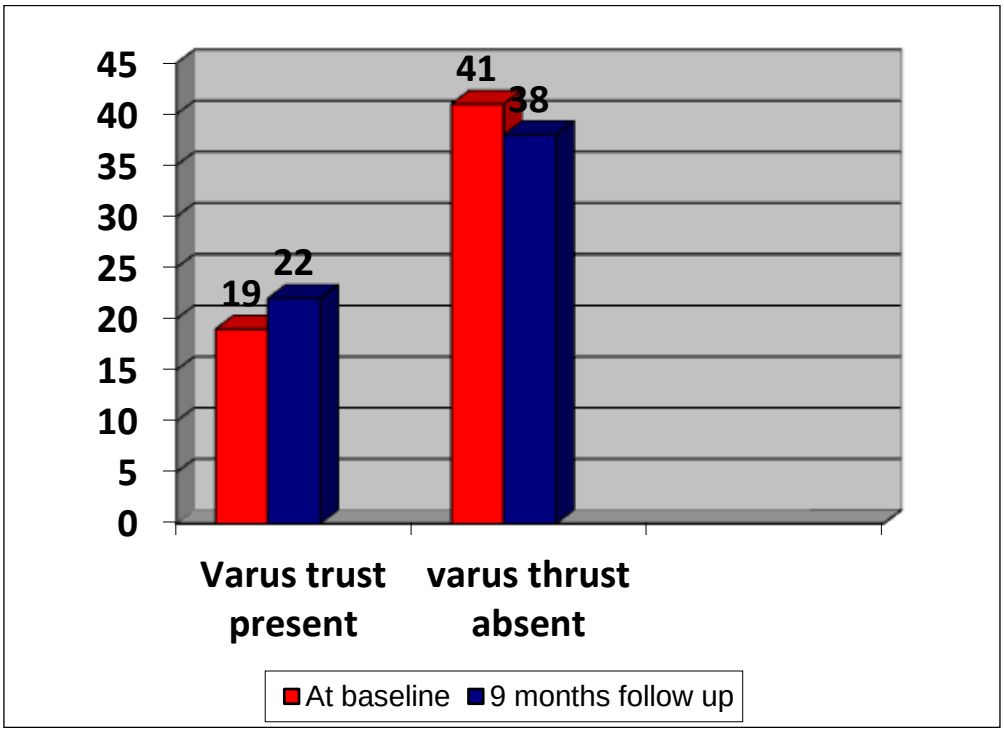

Fig-1 : Presence or absence of varus thrust wise distribution of patients.

Table 7: Comparison of varus thrust at baseline and at 9 months follow up .

	varus thrust	varus thurst after 9 months
Chi-Square	8.067[a]	4.267[a]
Df	1	1
Asymp. Sig.	P=0.005	P=0.039

DISCUSSION:

We evaluated the impact of varus thrust on progression of osteoarthritis knee in terms of clinical, functional and radiological variables. In our study Mean WOMAC score at baseline was 54.43 and 61.53 at 9 months follow up which was found statistically significant(p value = 0.000).The mean WOMAC score was compared with presence or absence of varus thrust and the difference was found to be significant statistically. That means patients having varus thrust showed increased functional disability in term of WOMAC score. Similar findings were observed by Grace H.LO[5].Mean chair stand rate at baseline was 16.98 and 14.73 at 9 months follow up. Chair stand

rate showed mean 1.95 decreases at 9 months follow up. Deterioration of chair stand rate at baseline and after 9 months follow up was statistically significant. (P value=0.00; P <0.05). Leena Sharma [6]also observed significant deterioration in chair stand performance in participant with OA knee associated with varus alignment of more than 5 degree. In our study out of 60 patients, 19 patients had varus thrust at the start of study and 22 had varus thrust at the end of 9 months follow up . So 3 patients out of 41 patients developed varus thrust eventually. The proportion of patients who eventually developed varus thrust at the end of follow up were statistically significant (p value 0.039). We also compared the Body Mass Index of patients with varus thrust and without varus thrust. It was found to be statistically insignificant (p value 0.071).Fixed flexion deformity of patients with varus thrust and without varus thrust were compared and was found to be insignificant statistically(p value 0.912) . Comparison in the chair stand rate of patients with varus thrust and without thrust found to be statistically significant(p value 0.004). However, Alison chang [7] observed that all knees at risk for OA progression (including those with static varus, valgus, or neutral alignment), a varus thrust was associated with a 4-fold increase (age-, sex-, BMI-,and pain-adjusted OR 3.96, 95% CI 2.11–7.43) in the likelihood of medial OA progression in the subsequent 18 months. Similar to our finding Grace H.Lo [5]observed that patient with versus without definite varus thrust had a total WOMAC pain score of 6.3 versus 3.9, (p value 0.007). When adjusting for age, sex, height, weight and walk speed, the difference in means was less pronounced and no longer significant, 5.7 versus 4.2,(p value 0.09). In long term study done by T. Miyazaki [8]observed that the patients who had varus thrust and adduction moment of limb positively affects the radiological progression of diseases. They studied 6 years follow up on 32 patients and concluded that there can be 6.34 times worsening of radiological grade when adduction(varus thrust increases by 1 %).

CONCLUSION

We can conclude that physical function in terms of WOMAC score and chair stand rate was significantly detoriate in a patients with varus malalignment and with varus thrust over a period of 9 months. The difference between mild and moderate symptomatic radiographic knee OA are not only structural but also functional, based on the magnitude of load in the medial knee joint. varus thrust may represent a knee ineffectively counteracting the movements of the knee resulting in instability and poor functional outcome. varus thrust has positive effect on clinicoradiological progression of OA knee. the reliability of study is questionable as sample size and duration of study was short.

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