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RESEARCH

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The relationship between static and dynamic postural deformities with pain and quality of life in non-athletic women

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Abstract

Background The assessment of the postural condition with functional tests are used with the least facilities in the shortest time, for a wide the range of movements for different parts of the body. Both static and dynamic posture measurements are predictive of injury. These two assessments provide different information regarding posture control. Also, with the advancement of this technology, the speed of posture assessment and deformity diagnosis can be increased and done with the minimum facilities. This can signal a new method for the quick diagnosis of abnormalities and ultimately prevent or correct psychological effects and musculoskeletal pain in the future. Because as seen according to the citations, abnormalities cause musculoskeletal pains, movement restrictions and ultimately affect the quality of life.

Methods The current research is of the applied and semi-experimental type, and in terms of the results it is of the relational and correlational type. In this research, 148 non-Athletic women from Fardis City participated, in which the results obtained from the static evaluation was analyzed by the Posture Screen application after taking photos from four directions using a smartphone, and also the dynamic evaluation was identified and analyzed by the researcher using the overhead squat test of compensatory movements, with the data that from Cornell pain and quality of life SF-36 questionnaires was. Data description and correlation between variables were done with the η coefficient method.

Results According to the findings there is a positive and significant correlation between the prevalence of uneven pelvic deformity and the amount of pain in non-athletic women ($P=0.036$, $\eta_{(148)}=0.17$). In other words, pain increased significantly when the pelvis was changed from a normal position to a lateral deviation position. Also, there is a negative and significant relationship between the prevalence of deformity of knee movement, back arch, straight back, heel lift and the quality of life in non-athletic women ($P=0.020$, $\eta_{(148)}=0.19$).

Conclusions According to the results, deformities have an effect on pain and the frequency of pain, on the other hand, in the present study, dynamic evaluations showed deformities more accurately than static evaluations.

Keywords Static deformities, Dynamic deformities, Quality of life, Pain, SF-36

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Introduction

Of the consequences of modern life are the occurrence of postural disorders and pain in musculoskeletal structures. These disorders are influenced by several factors such as lack of movement, muscle imbalances, physical characteristics of the person, the process of physical maturation especially the fast growth of bones, nutritional disorders especially vitamin D deficiency, sitting for long periods of time, incorrect and inappropriate habits in sitting and standing, carrying bags and backpacks improperly, carrying a heavy bag, incorrect movement patterns, mental-psychological characteristics and other such cases [1].

Muscle imbalance that may be due to the shortness of some muscle groups and also the weakness of another group of muscles [2]. Muscle imbalance syndrome is a condition that often manifests itself as chronic pain, and to date, few people have paid attention to it [3]. From a structural point of view, the pathology of the static structure of the position is investigated and the diagnosis of the cause is mainly done based on local assessment and tests such as CT scan, MRI, X-ray, etc. But from a functional point of view, the function of all body systems is expressed together. The structural view is more about acute injuries, but the functional view is more recommended in cases of chronic musculoskeletal pain [4].

The occurrence of these muscle imbalances and ultimately the manifestation of deformation in posture causes back pain, walking disorders, shortness of breath, and instability which leads to falls and impaired activities of daily living (ADL) [5]. On the other hand, musculoskeletal and nerve injuries, pain, and muscle imbalance may lead to inefficient movement patterns and poor posture. Postural imbalance includes deviation from ideal alignment. The asymmetry between the left and right side of the body can be associated with the rotation of a part of the body in the sagittal, transverse or frontal planes and cardiovascular-respiratory dysfunction, physical and psychosocial health [3, 6].

Mobility is fundamental to participation in physical activity, the reduction of injury risk, and the quality of life, all of which are key components of lifelong health. Musculoskeletal deformities, especially spine deformities, is a heterogeneous disease that, depending on the type and severity of the deformity, can have a debilitating effect on health, which is often more recognized than the disability of chronic diseases [7]. It has been observed, in various researches, that these factors can affect the quality of life of people with musculoskeletal abnormalities [8, 9]. On the other hand, in the undertaken studies, it has been revealed that the abnormalities of the sagittal axis have a significant effect on the quality of life of people, and the person suffering from these deformities is led to depression [10, 11].

The assessment of the postural condition with functional tests are used with the least facilities at the shortest time for a wide the range of movements for different parts of the body. Both static and dynamic posture measurements are predictive of injury. These two assessments provide different information regarding posture control. Functional movement screening and posture assessment have been proposed for use in predicting the risk of injuries and deformities in active and inactive populations, but time constraints may limit the use of a general protocol for this screening test [4].

In the last decade, due to the advancement of technology in the field of smart mobile phones and the increase of applications in all fields, including, evaluations with acceptable validity and reliability in the process of functional screening and assessments of posture, the speed of the diagnosis of musculoskeletal abnormalities and, following that, the occurrence of problems in movement ability has increased [12]. Also, with the advancement of this technology, posture assessment and deformity detection can be done faster with minimal facilities. This can be prospective of a new method for quick diagnosis of these abnormalities, and finally, to prevent or correct psychological effects and musculoskeletal pains in the future, because, as seen according to the citations, these abnormalities also cause musculoskeletal pain and movement restrictions and ultimately affect the quality of life [13].

Currently, screening of the spine and back as a part of preventive health care for adults is less considered. On the other hand, there are different types of evaluations and screenings, in which, with the passage of time and the advancement of technology, the methods of assessing posture and deformities are done more quickly. Therefore, it seems that due to the importance of screenings, predictions and prevention of complications caused by these abnormalities and the impact of abnormalities on the quality of life and musculoskeletal pain, a systematic program with faster access has not been provided. Therefore, screening and evaluation using smartphone application technology and identifying its relationship with quality of life and musculoskeletal pain seem necessary. In this research, the existing device and the new software with low cost and high efficiency were used, and a comparison of two static and dynamic evaluations was done.

Methods

The current research is of the applied and correlational method. In this research, 148 non-athletic women participated, and the results obtained from the static evaluation by the Posture Screen application and the dynamic evaluation by the overhead squat test were analyzed with the information obtained from the Cornell pain questionnaire and SF-36 quality of life questionnaire, and the effect of the two evaluations was evaluated based on the results from the two questionnaires.

Research entry criteria

1. The samples were female.
2. They had not done any sports activities until the time of the study.
3. They did not suffer from chronic or acute diseases such as Diabetes, Cancer, Cardiovascular disease, Respiratory disease, Neurological diseases, Blood pressure.
4. They had not done any orthopedic surgery.
5. They had no congenital abnormalities.
6. Their place of residence was in Alborz province, Iran.
7. The occupation of the samples was not sports coach or athlete.
8. They had no history of any mental illness.
9. They had no history of musculoskeletal injury or trauma.
10. They were not pregnant.

Research exclusion criteria

1. Failure to learn and perform tests accurately.
2. Use of any painkillers (up to two weeks before the test).
3. Using sleeping pills (at least two weeks before the test).
4. The presence of acute pain caused by the injury during the tests.
5. Catching a disease such as cold, corona, etc. during the tests.

BMI, weight and Height

In this study, the maximum, minimum and average BMI (Table 1), weight (Table 2), height (Table 3) are mentioned in the following tables:

Table 1 BMI of participants

BMI	Minimum	Maximum	Mean
	17.70	38.06	25.37

Table 2 Weight of participants

Weight (kg)	Minimum	Maximum	Mean
	42.00	119.0	68.57

Table 3 Height of participants

Height (cm)	Minimum	Maximum	Mean
	150.0	180.0	164.2

For static evaluation, the subject stood anatomically with minimal clothing, and the desired points on the person's body were marked with a marker, then four photos were taken of the person using a mobile phone and the Posture Screen application from four sides (front, back, and the two sides). In this application, after selecting the new screen option, the details of the subject including gender, height, weight, and date of birth were recorded, then the application was adjusted to evaluate either 2 or 4 directions (front, back, left, right), then the camera was turned on and the height of the picture was set according to the person's height so that the whole body was included in the frame (Fig. 1). When the camera was at the right angle, the vertical and horizontal lines in the center of the image would turn green, then the 'use photo' option was selected and the determined lines on the screen were placed one above the head of the subject and the other below her feet. Then the same process was followed from the other angles of the photo. Also, the 'begin posture analysis' option was selected and the 'landmarks' of the application were set on the points that follow. In the front view: eyes, tip of the nose, Acromion process, sternum, ribs connected to T8, ASIS, the middle of the patella, and end of the tibia. From the side view: ear lobe, shoulder joint, hip joint, the lateral epicondyle, and lateral Malleolus. From the posterior view: the C7, T4, T8, T12, L3 vertebrae, the ribs connected to T8, PSIS and the back of the heel. Then the application would perform the evaluation statically, and it displays the skeletal and muscular deviation angles in each part of the body by mentioning the degree in four separate tables, each of which is specific to one view. This application examines the angles of the ankles, knees, hips, trunk, shoulders, head, lumbar arch, thoracic arch, and the structural abnormalities of the person, which are determined by mentioning the angles [14, 15].

Then, for dynamic evaluation with the overhead squat test, the person, in a standing position with the hands parallel to the body, performed the overhead squat movement five times in each direction and a video was recorded with a mobile phone from three directions (front, back, and side of the person) during the movement (Fig. 2). Then the video was analyzed by the

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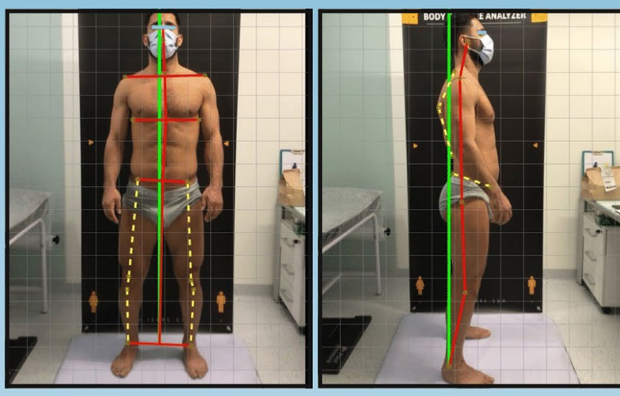
PostureScreen®
Accurate Postural Assessment

Exam for [redacted] performed on 01/11/2023

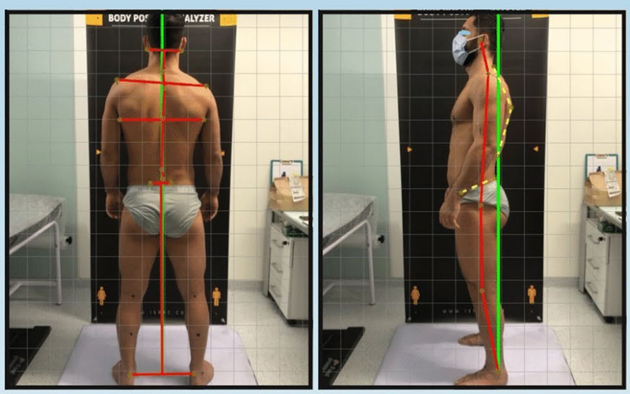
Anterior View **RIGHT VIEW**



Posture Displacements

Body Region	Anterior Translations	Anterior Angulations	Lateral Translations	Lateral Angulations
Head	0.73 cm right	3.8° right	3.22 cm forward	11.60° flexed
Shoulder	0.54 cm right	1.1° right	0.88 cm backward	0°
Ribcage	1.40 cm left	n/a	n/a	n/a
Hip/Pelvis	1.38 cm left	3.0° left	1.34 cm backward	1.97° extended
Knee	n/a	n/a	6.95 cm forward	12.31° flexed
Total	4.05 cm	8.0°	12.39 cm	25.9°

Posterior View **LEFT VIEW**



Estimated Effective Head Weight secondary to head vs. shoulder posture is 15.2 kgs instead of 6.6 kgs

Averaged Lateral Displacements

	Head	Shoulder	Hip/Pelvis	Knee
Lateral Translations	3.29 cm	2.07 cm	0.94 cm	6.99 cm
Lateral Angulations	12.29° flexed	1.64° extended	0.99° extended	11.87° flexed

Posture Displacements

Body Region	Posterior Translations	Posterior Angulations	Lateral Translations	Lateral Angulations
Head	1.21 cm right	2.7° right	3.35 cm forward	12.98° flexed
Shoulder	0.12 cm left	4.0° left	3.26 cm backward	3.29° extended
Ribcage	0.38 cm right	n/a	n/a	n/a
Hip/Pelvis	0.52 cm left	0°	0.54 cm forward	0°
Knee	n/a	n/a	7.03 cm forward	11.44° flexed
T1-T4	0.62 cm left	4.9° left	n/a	n/a
T4-T8	0.76 cm right	3.3° right	n/a	n/a
T8-T12	0.29 cm right	0°	n/a	n/a
T12-L3	0.43 cm left	5.9° left	n/a	n/a
L3-Mid PSIS	0.83 cm right	24.4° right	n/a	n/a
Total	5.16 cm	45.4°	14.19 cm	27.7°

Fig. 1 Static Evaluation (Posture Screen Application)

researcher and, according to performing compensatory movements and also to the NASM protocol of musculoskeletal abnormalities, muscles that had been inhibited or shortened were identified and possible injuries were predicted according to the results of the analysis.

In the dynamic evaluation of the overhead squat, the following points are taken into account:

Views

1. View feet, ankles, and knees from the front. The feet should remain straight with the knees tracking in line with the foot (second and third toes). 2. View the Lumbo- Pelvic Hip Complex (LPHC), shoulder, and cervical complex from the side. The tibia should remain in line with the torso while the arms also stay in line with the torso. 3. View the foot and ankle complex and the LPHC from behind. The foot and ankle complex will demonstrate slight pronation, but the arch of the foot will remain visible. The feet should also remain straight while the heels stay in contact with the ground. The LPHC should not shift from side to side.

Anterior View: 1. Feet: a. Do the feet flatten and/or turn out?

2. Knees: a. Do the knees move inward (adduct and internally rotate)? b. Do the knees move outward (abduct and externally rotate)?

Lateral View: 1. LPHC: a. Does the low back arch (excessive spinal extension)? b. Does the low back round (excessive spinal flexion)? c. Does the torso lean forward excessively?

2. Shoulder: a. Do the arms fall forward?

Posterior View: Low Back Rounds Excessive Forward Lean Arms Fall Forward

1. Feet: a. Do the feet flatten (excessive pronation)? b. Do the heels rise off the floor?

2. LPHC: a. Is there an asymmetric weight shift?

Because posture is a dynamic quality, these observations can show postural distortions and potential overactive and underactive muscles in a naturally dynamic setting. Both types of assessments place a different demand on the HMS, so performing both transitional and dynamic assessments can help provide a better observation of one's functional status. The overhead squat assessment is used to assess dynamic flexibility, core strength, balance, and overall neuromuscular control. There are some studies that confirm the use of transitional movement assessment like as overhead squat evaluation [16, 17]. This assessment appears to be a reliable and valid measure of lower extremity movement patterns. Also, the evaluation of the overhead squat shows the movement patterns of the lower limbs during landing and jumping [18]. Knee valgus during the overhead squat test indicates a decrease in hip and abductor external rotation [19], an increase in hip adductor activity [16], and limited ankle dorsiflexion [17, 20]. These results suggest that the movement disorders observed in this assessment may be the result of changes in joint motion, muscle

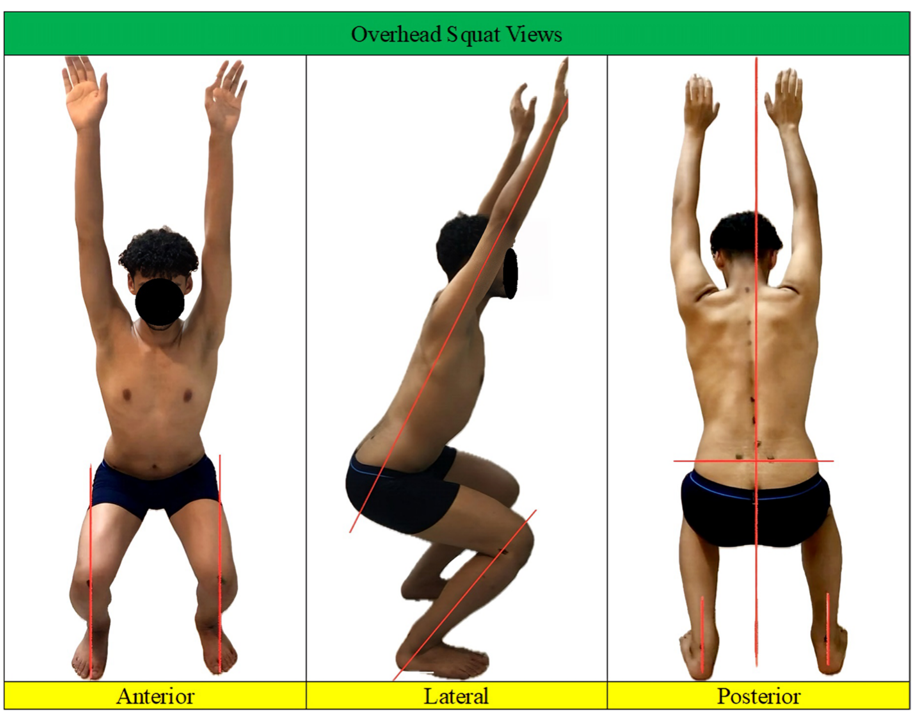


Fig. 2 Dyanim Evaluation (Overhead Squat Test)

activation, and overall neuromuscular control that can increase injury risk [17, 20].

Then the subjects completed two questionnaires of Cornell pain and quality of life SF-36.

Cornell Pain Questionnaire provides information about the presence and intensity of pain and discomfort in 12 parts of the body provided through self-reporting, including neck, left and right shoulders, upper back, left and right upper arms, lower back, left and right forearms, left and right wrists, hip, left and right thighs, left and right knees, left and right lower legs, left and right soles [21, 22].

The quality of life questionnaire (SF-36) has 36 questions and consists of eight scales, each scale consisting of 2 to 10 items. The subscales of this questionnaire are:

1. Physical function (PF)
2. Role disorder due to physical health (RP)
3. Role disorder due to emotional health (RE)
4. Energy/fatigue (EF)
5. Emotional well-being (EW)
6. Social function (SF)
7. Pain (P)
8. General health (GH)

Findings

The collected information is described and analyzed in two parts. In the first part, the research variable using descriptive statistics indicators like, mean, standard deviation, related tables and graphs are described. Finally, research hypotheses are tested using appropriate statistical tests. Non-parametric indicators of static and dynamic evaluation of qualitative variables and for quality of life and pain index, distance with ETA (η) coefficient with confidence level of $P=0.05$ and SPSS version 26 software was used.

Result

Table 4 describes the age variables. Tables 5 and 6 show the description of static and dynamic deformities, respectively. Table 7 also describes the mean and standard deviation of quality of life and pain questionnaires.

In this study, there was a positive and significant relationship between the prevalence of uneven pelvis deformity and the amount of pain in non-athlete women ($P=0.036$, $\eta_{(148)}=0.17$). In other words, pain increased significantly when the pelvis was misplaced from a normal position to uneven pelvis position (Table 8).

Table 4 Description of age variables

Variable	The Least	The Most	Average	The Standard Deviation
Age	20	40	32.15	7.1

Table 5 Description of static deformities

Variable	Classes	Frequency	Relative Frequency
Torticollis	Has it	86	58/1
	Does not Have	62	41/9
Forward head	Has it	49	33/1
	Does not Have	99	66/9
Uneven Shoulder	Has it	79	53/4
	Does not Have	69	46/6
Hyper Kyphosis	Has it	100	67/6
	Does not Have	48	32/4
Hyper Lordosis	Has it	104	70/3
	Does not Have	44	29/7
Sway Back	Has it	109	73/6
	Does not Have	39	26/4
Scoliosis	Has it	116	78/4
	Does not Have	32	21/6
Uneven Pelvis	Has it	103	69/6
	Does not Have	45	30/4
Genu Valgus	Has it	131	88/5
	Does not Have	17	11/5
Genu Varum	Has it	108	73
	Does not Have	40	27
Genu Recurvatum	Has it	130	78/8
	Does not Have	18	12/2

Table 6 Description of dynamic deformities

Variable	Classes	Frequency	Relative Frequency
Feet Turns Out	Has it	145	98
	Does not Have	3	2
Feet Flatten	Has it	99	66/9
	Does not Have	49	33/1
Knee Move Inward (Valgus)	Has it	100	67/6
	Does not Have	48	32/4
Knee Move Outward	Has it	93	62/8
	Does not Have	55	37/2
Excessive Forward Lean	Has it	106	71/4
	Does not Have	42	28/4
Low Back Arches	Has it	104	70/3
	Does not Have	44	29/7
Low Back Rounds	Has it	136	91/9
	Does not Have	12	8/1
Arm Fall Forward	Has it	94	63/5
	Does not Have	54	36/5
Heel of Foot Rises	Has it	135	91/2
	Does not Have	13	8/8
Asymmetrical Weight Shift	Has it	69	46/6
	Does not Have	79	53/4

Table 7 Description of quality of life and pain

Variable	Average	The Standard Deviation
Quality of Life	280/6	70/3
Pain	21/2	24/5

Table 8 Coefficient Hη for static deformity and pain

Variable	Pain		
	η	*N*	Sig.
Torticollis	0/077	148	0/350
Forward head	-0/022	148	0/789
Uneven Shoulder	0/116	148	0/162
Hyper Kyphosis	0/088	148	0/288
Hyper Lordosis	0/020	148	0/811
Sway Back	-0/070	148	0/399
Scoliosis	0/079	148	0/341
Uneven Pelvis	0/172	148	[*]0/036
Genu Valgus	0/00	148	0/995
Genu Varum	0/078	148	0/349
Genu Recurvatum	-0/056	148	0/502

[*] *P* = 0/036, It indicates a direct correlation relationship

Table 9 Coefficient Hη for dynamic deformity and pain

Variable	Pain		
	η	*N*	Sig.
Feet Turns Out	-0/109	148	0/187
Feet Flatten	0/046	148	0/582
Knee Move Inward (Valgus)	0/125	148	0/131
Knee Move Outward	-0/151	148	0/067
Excessive Forward Lean	0/111	148	0/181
Low Back Arches	-0/126	148	0/127
Low Back Rounds	0/008	148	0/927
Arm Fall Forward	-0/044	148	0/597
Heel of Foot Rises	0/067	148	0/421
Asymmetrical Weight Shift	-0/066	148	0/428

In this study, no significant relationship was found between dynamic evaluation and pain (Table 9).

The results in Table 10, no significant relationship was found between static evaluation and quality of life.

In this result (Table 11), There was a negative and significant relationship between knee movement inward (valgus) and quality of life ($P = 0.020$, $\eta_{(148)} = -0.191$). In this way, the quality of life of participation has decreased with the increase of knee movement inward in the overhead squat movement.

Table 10 Coefficient Hη for static deformity and quality of life

Variable	Quality of Life		
	η	*N*	Sig.
Torticollis	-0/038	148	0/649
Forward head	0/014	148	0/865
Uneven Shoulder	-0/113	148	0/107
Hyper Kyphosis	-0/098	148	0/236
Hyper Lordosis	-0/005	148	0/953
Sway Back	-0/032	148	0/695
Scoliosis	-0/026	148	0/753
Uneven Pelvis	-0/049	148	0/551
Genu Valgus	0/00	148	0/996
Genu Varum	-0/0125	148	0/132
Genu Recurvatum	-0/048	148	0/565

Table 11 Coefficient Hη for dynamic deformity and quality of life

Variable	Quality of life		
	η	*N*	Sig.
Feet Turns Out	0/069	148	0/405
Feet Flatten	0/068	148	0/409
Knee Move Inward (Valgus)	-0/191	148	[a]0/020
Knee Move Outward	0/120	148	0/146
Excessive Forward Lean	0/002	148	0/983
Low Back Arches	0/151	148	0/067
Low Back Rounds	0/008	148	0/212
Arm Fall Forward	0/103	148	0/992
Heel of Foot Rises	-0/001	148	0/080
Asymmetrical Weight Shift	0/049	148	0/555

[a] It indicates an inverse correlation relationship

The results in Table 12 showed that there was a significant relationship between the static deformity of the uneven shoulder and the Genu Recurvatum with the physical function of the quality of life ($p < 0.05$). That is, with the increase of static deformity of uneven shoulder and Genu Recurvatum, the physical function of the quality of life decreased. There was a relationship between the static deformity of the Genu Recurvatum and the role disorder due to physical health ($p < 0.05$). That is, by changing the position from the normal position to the Genu Recurvatum, it was directly related to physical health disorder. There was a relationship between uneven shoulder static deformity and role disorder due to emotional health ($p < 0.05$). That is, by changing the position from the normal position to the uneven shoulder position, it increased emotional health disorders. No significant relationship

Table 12 Coefficient of expansion for static deformity and physical function

Variable	Physical function	physical health	emotional health	Energy/fatigue	Emotional well-being	Social function	Pain	General health
	H	η	η	η	η	η	η	H
Torticollis	0/099	0/05	0/08	0/10	0/07	0/06	0/15	0/05
Forward head	0/024	0/02	0/03	0/007	0/008	0/08	0/027	0/028
Uneven Shoulder	0/14[a]	0/11	0/16[a]	0/07	0/07	0/01	0/006	0/088
Hyper Kyphosis	0/019	0/08	0/049	0/11	0/09	0/04	0/11	0/091
Hyper Lordosis	0/03	0/03	0/039	0/07	0/14	0/01	0/02	0/049
Sway Back	0/11	0/07	0/06	0/03	0/13	0/04	0/13	0/05
Scoliosis	0/09	0/02	0/05	0/04	0/08	0/05	0/02	0/11
Uneven Pelvis	0/14	0/05	0/01	0/07	0/003	0/06	0/08	0/10
Genu Valgus	0/09	0/02	0/12	0/06	0/01	0/001	0/007	0/009
Genu Varum	0/05	0/08	0/06	0/08	0/14	0/10	0/004	0/06
Genu Recurvatum	0/15[a]	0/15[a]	0/09	0/00	0/08	0/03	0/04	0/04

[a] It indicates an inverse correlation relationship

was observed between other static deformities and quality of life components ($p < 0.05$).

The results in Table 13 showed that there was a significant relationship between Heel rises and physical function of quality of life ($p < 0.05$). That is, by changing the posture from the normal posture to the dynamic deformity posture of Heel rises, the physical function of the quality of life decreased. Also, a significant relationship was found between Knee move inward and quality of life due to role disorder as a result of physical health ($p < 0.05$). That means, In the dynamic evaluation (overhead squat) by changing the knee position from the normal position to the compensatory inward rotation movement, the subscale of emotional health decreased in the quality of life, or in other words, the internal rotation of the knee has an inverse significant relationship with emotional health. Also, between abnormality the dynamic of the lumbar arch and the role disorder subscale caused by emotional health in the quality of life, an inverse significant relationship was observed ($p < 0.05$). That is, by changing from the normal state to the deformed state of lumbar arch dynamics, the subscale of emotional health in quality of

Table 13 Correlation coefficient of deformities caused by dynamic evaluation (overhead squat) and quality of life subscales

Variable	Physical function	physical health	emotional health	Energy/fatigue	Emotional well-being	Social function	Pain	General health
	η	η	η	η	η	η	η	H
Feet Turns Out	0/093	0/10	0/07	0/081	0/02	0/00	0/03	0/01
Feet Flatten	0/007	0/00	0/09	0/14	0/09	0/14	0/06	0/055
Knee Move Inward (Valgus)	0/15	0/18[a]	0/11	0/05	0/05	0/09	0/20[a]	0/067
Knee Move Outward	0/03	0/13	0/12	0/02	0/03	0/03	0/11	0/02
Excessive Forward Lean	0/034	0/01	0/032	0/08	0/03	0/01	0/15	0/017
Low Back Arches	0/050	0/050	0/29[b]	0/14	0/10	0/07	0/056	0/10
Low Back Rounds	0/074	0/11	0/003	0/10	0/19[a]	0/16[a]	0/073	0/024
Arm Fall Forward	0/013	0/008	0/07	0/06	0/02	0/02	0/07	0/04
Heel of Foot Rises	0/16[a]	0/07	0/03	0/12	0/12	0/12	0/17[a]	0/003
Asymmetrical Weight Shift	0/043	0/029	0/13	0/007	0/02	0/08	0/03	0/038

[a] It indicates an inverse correlation relationship

[b] It indicates a stronger inverse correlation relationship

life was observed with a stronger significant decrease. In other words, an increase in lumbar arch was associated with a decrease in emotional well-being ($p<0.05$). That is, by changing the state from the normal state to the dynamic deformation state of the Low back rounds, the emotional well-being dimension of the quality of life decreased significantly. Also, an inverse significant relationship was found between Low back rounds and social functioning dimension of quality of life ($p<0.05$). That is, by changing the state from the normal state to the dynamic deformity state of the Low back rounds, the social function dimension of the quality of life decreased. Also, a direct significant relationship was found between Knee move inward and quality of life pain dimension ($p<0.05$). That is, by changing the structure from the normal position to the dynamic deformity position, the pain dimension of the quality of life increased. That is, by changing the position from the normal position to the dynamic position of Knee move inward, the pain dimension of the quality of life increased. Also, a direct significant relationship was found between the Heel rises and the pain aspect of quality of life ($p<0.05$). That is, the pain dimension of quality of life increased by changing part of the body from the normal position to the dynamic deformity position of the Heel rises. Finally, no significant relationship was observed between dynamic deformities and other dimensions of quality of life ($p<0.05$).

Discussion

In the current study, due to the age range of the statistical population, it was not possible to access a wider range of women and use other evaluation protocols due to the COVID-19 pandemic. Also, due to the conditions of the evaluation, which was with minimal clothing and the subjects were photographed. Many subjects refused to participate in the test.

The main findings of the present study show that Musculoskeletal assessment simultaneously with static and dynamic methods, can provide more important and comprehensive information about the postural condition of people. On the other hand, the findings derived from the research hypotheses show that the existence of musculoskeletal abnormalities can affect pain scales and indicators of people's quality of life and a person's physical, mental, and social health.

Relationship between static and dynamic deformities with pain

The relationship between static deformities and pain was shown that in this study the pain increased significantly by changing the pelvis from the normal position to the lateral deviation position. However, no pain was observed in other abnormalities (torticollis, forward head, uneven shoulder, hyperkyphosis, etc.) or was not statistically significant. These results were also observed in several studies.

One study carried out by Wang and associates (2022), with the purpose of "Investigating Impaired static postural control with trunk muscle contraction ability in young adults with chronic non-specific low back pain", concluded that compared with healthy subjects, impaired postural control in young-adult patients with CNSLBP during a static position with eyes open is associated with weak contraction of bilateral transverse abdominis muscles and normal contraction of the right lumbar multifidus. During other situations in patients and control group, no significant relationship was observed between postural control and trunk muscle contraction. These findings suggest that young patients with CNSLBP may be in the early stages of a neuromuscular adaptation. This mechanism of neuromuscular adaptation provides theoretical evidence that treatments and trunk muscle strengthening can improve impaired postural control in patients with CNSLBP [23].

In another study, Ozdemir and associates (2021) sought to evaluate "Musculoskeletal Pain, Related Factors, and Posture Profiles Among Adolescents". The study revealed that the postural condition was associated with musculoskeletal pain and was dependent on physical activity, the comfort of the school desk, and the grade of the school condition of adolescents. It was therefor recommended that teenagers be taught the correct and ergonomic posture when using a computer, carrying a school backpack, and sitting on a school chair so as to prevent musculoskeletal pain.

In non-athletic women, no correlation was observed between the pain level and the prevalence of measured dynamic deformities such as Rotation of the legs, straightening of legs, inward distortion of knees, outward distortion of knees, increasing bending, back arch, straight back, placing the hands in the front, raising heels, asymmetric weight bearing [24].

In the research literature, the results were different. In a study by Rosen and associates (2018), they investigated "The relationship between acute pain and dynamic pastural stability indices in individuals with patellar tendinopathy". The research question was whether there is a relationship between acute pain and pastural stability indicators in people with patellar tendinopathy. Twenty-two recreationally active individuals with patellar tendinopathy participated. The subjects executed a jump using both legs and landed on a designated limb on a force plate. They were asked to complete visual analog scales (VAS) measuring 100 mm in length before and after the landing trials. The stability indices, namely anterior posterior (APSI), mediolateral (MLSI), vertical (VSI), and composite (DPSI), were computed based on the data obtained from the ground reaction force. As individuals with patellar tendinopathy experienced an increase in pain, the values of postural stability indices also increased, indicating a greater challenge in transitioning from a dynamic to a static state. Although balance deficiencies are not typically associated with patellar tendinopathy, it seems that there may be a connection between pain and postural stability in these particular individuals [25].

In another study, Sung and associates (2017) studied "Kinematic chain reactions on trunk and dynamic postural steadiness in subjects with recurrent low back pain". Participants with recurrent low back pain (LBP) showed a change in trunk control, but the kinetic and kinetic reactions of the trunk were not carefully investigated. This study was conducted to compare standing time, spinal range of motion (ROM), and dynamic postural stability index (DPSI) based on visual status between people with and without recurrent LBP during vertical one-leg standing. Sixty-three subjects participated in the study, including 34 controls and 29 subjects with recurrent low back pain. (DPSI) was a combination of mediolateral (MLSI), anterior-posterior (APSI), and vertical stability (VSI) indices on a force platform. The results of this study showed that the LBP group reduced the thoracic and lumbar spine rotations under eyes-closed conditions. The LBP group also showed a positive correlation with kinetic indices and increased dynamic postural stability in eyes-closed conditions to possibly prevent further pain or injury. This dynamic postural stability approach is crucial for enhancing the reactions of the kinetic and kinematic chains in the group with lower back pain (LBP). This compensatory pattern supports the development of effective strategies for modifying posture to prevent the recurrence of LBP and may serve as a chain reaction to safeguard trunk control in the absence of visual input [26].

The relationship between static and dynamic postural deformities with the quality of life

A correlation was observed between the prevalence of static deformities (torticoli, forward head, uneven shoulder, hyperkyphosis, hyperlordosis, etc.), and some quality of life factors in non-athlete women. The obtained results can be influenced by the life habits and lifestyle of the statistical population. In the analysis of static deformity data and the quality of life questionnaire, it was observed that uneven shoulder and genu recurvatum had an effect on physical function, that is, in these people, individual needs such as walking, sports movements, and flexibility are associated with disorders, as well as genu recurvatum. It had a direct relationship with the limiting factors of physical ability, in other words, it affected physical health. Uneven shoulders seemed to have an impact on emotions that disrupt work and daily activities. Therefore, it seems that more research is needed to be done in this regard. However, the results of this research were not in line with Ucurum et al. (2020), which sought to study "Comparison of the spinal characteristics, postural stability and quality of life in women with and without osteoporosis" the results showed that the spine is affected in women with osteoporosis compared to healthy women. In women with osteoporosis, the angle of the thoracic spine was increased, the angle of the spine was decreased and the length of the spine was shortened. In addition, when examining the spine's response to loading, only the spine's tilt angle changed significantly over the 30-s period in healthy subjects, while the angle of the spine and the angle of the chest showed a change in people with osteoporosis. For the diagnosis of osteoporosis, the cutoff points for sagittal thoracic curvature and spine length were 60° and 447 mm, respectively. However, there was no difference between the two groups in terms of quality of life [27].

On the other hand, the results of our study were consistent with some studies. Saad and associates (2021) conducted a study on 93 adult subjects with spinal deformity. All of them had spine abnormalities that affected their quality of life and daily activities. All subjects were subjected to 3D motion analysis during sit-to-stand and stand-to-sit movements, and the range of motion of the hip, lower limb, chest, head and spine sections was calculated on the kinematic waveform. Also, all the subjects had completed the SF-36 quality of life questionnaire. They showed moderate levels of pain as well as higher levels of depression [28].

In our research, the relationship between dynamic deformities and quality of life, observing the abnormality of the knee move inward in the overhead squat test showed to have an effect on the overall quality of life of non-athletic women, and the results of this questionnaire reported a decrease in the quality of life in these people.

In the microanalysis of the quality of life questionnaire, dynamic deformities of knee move inward were seen on the limiting factors of physical ability and interference with pain in daily activities. The increase in Low Back Arches showed a lot of interference on emotional factors disturbing work and daily activities, as well as Low Back Rounds deformity as a factor causing interference in the psycho-emotional dimension with daily activities and performing social activities and communication with family, friends and the community was recognized. Heel of Foot Rises in dynamic assessments also affected individual needs such as activities of daily living.

In a research in line with the results of the current research, dynamic pastural control with activities of daily living and quality of life in patients with knee arthritis was carried out in 2021. Knee osteoarthritis negatively affected dynamic postural control, which is a fundamental function that people use to perform activities of daily living. 36 patients with osteoarthritis, 29 of whom were women, participated in this study. They would stand on the force plate and raise their less injured leg as fast as possible, and stand on one leg with the more injured limb. These findings suggest that poor dynamic postural control is somewhat associated with poor quality of life conditions in patients with knee osteoarthritis [29].

In the present study, the alignment and non-alignment of the results can be due to the separate evaluation of each abnormality.

In general, according to the age range of the statistical population in this research, due to the maturity of the statistical population, it can be assumed that people's pain tolerance threshold is higher or they may have more frequency with pain and experience some kind of adaptation to pain during their life and daily activities. Therefore, it has also affected their quality of life.

Also, in this research, the dynamic evaluation of the measurement criterion showed better prediction and diagnosis than the static evaluation. Because it was also seen in other studies that overhead squat, as a component of dynamic evaluation, can better predict damage and abnormalities (especially muscle imbalance).

Conclusion

The present study showed that the presence of musculoskeletal deformities in people can affect the quality of life, pain, pain intensity and pain frequency. Therefore, it is possible to say that the occurrence of pain will have its effects on the quality of life over time. On the other hand, with the availability of smartphones and specialized applications for musculoskeletal assessment, assessments can be recorded and analyzed faster and easier. Using some musculoskeletal evaluation devices requires expertise and time-consuming analysis. clinical imaging such as X-ray or CT scan, in addition to side effects for health, is expensive, time-consuming and less available. In our study, working with a smartphone and application is very simple and accessible and does not require a specialized device. In this study, the Posture Screen application was used for static evaluation, which, compared to standard tests, seems to needs to improve sensitivity, validity and more research. But in this study, it was observed that the static assessment of uneven pelvis had a direct correlation with pain. Also, the movement inside the knees during the overhead squat assessment lowered the quality of life of non-athletes. According to the current research, there is a need to follow up and do more research.

Supplementary Information

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Supplementary Material 1.

Authors' contributions

M.B: Wrote the main manuscript text, design of the work, data collector, interpretation of data. B.G: Design of the work, interpretation of data. MH.N: Design of the work, interpretation of data. M.A: Design of the work, interpretation of data. AH.SF: Wrote the main manuscript text, data collector, interpretation of data.

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No.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available due my subjects were all women, Muslims, and with minimal clothes, I have committed to them as a researcher at the beginning of the research that their photos will not be published anywhere, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval from the Islamic Azad University – Karaj Branch Medical Ethics Committee Faculty of Medicine was obtained for this study (no. IR.IAU.K.REC.1399.064). All methods were carried out in accordance with the relevant guidelines and regulations. Prior to any study procedure, each patient provided written informed consent to participate. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

Written consent for publication has been obtained from the patient shown in Figs. 1 and 2.

Competing interests

The authors declare no competing interests.

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