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Kinematic analysis of chakrasana in yoga

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Abstract

The purpose of the study was to see the correlation of selected angular and linear kinematic variables and performance of chakrasana in yoga. 10 students (boys) on the basis of purposive sampling technique of age 20 ± 2 years were selected as a subject from Jiwaji University, Gwalior, those who had been undergoing training. The performance was recorded on the basis of execution of the skill. This was evaluated by 3 judges during final phase, and sequential photography was done at sagittal plane with the help of Canon- EOS T3 motor driven camera. From the photographic sequence, the stick figures were prepared by using joint point method, and segmentation method was used to measure the selected linear kinematic variable at selected moments. To see the correlation between performance of hurdle clearance and selected angular and linear kinematic variables at selected moments, the Pearson's correlation coefficient was employed and found significant correlation in the angular kinematic variables i.e. Ankle joint (right), Knee Joint (right), Hip Joint (right), Shoulder Joint (right), Elbow Joint (right), Wrist Joint (Right) at 0.05 level of significance.

Keywords: Angle at elbow, angle at shoulder, angle at hip, angle at knee, angle at ankle, centre of gravity

Introduction

The science of biomechanics is concerned with the force, which act on a human body and the effects, which these forces produce. The internal and external forces acting on a human body determine how the parts of the body move during the performance of motor skill.

Biomechanics is relatively young as a recognized field of scientific inquiry biomechanical considerations is of interest in several different scientific disciplines and professional fields. Biomechanical instructors may have academic backgrounds in zoology; orthopedic, cardiac, or sports medicine; biomedical or biomechanical engineering; physical therapy; or kinesiology.

Yoga is a word derived from "Yuj" root of Sanskrit which means union. Yoga is the union of soul with spirit. The union of soul and spirit is a long process which may take even many births according to Hindu scriptures. Yoga is also considered as union of ida nerve and pingla nerve, union of sun nerve and moom nerve, union of negative and positive, union of shiva (spirit) with shakti (mother nature) and union of mooladhara chakra(coccyx plexus) with sahasara chakra (thousand lotus petal plexus). Yoga is a union of prana vayu with apan vayu (life current with excretion current).Yoga is a science of experience which is meant for the upliftment of humanity, from animal hood to godlihood and become one with the spirit.A science which can bring perfect happiness in the life of human beings. (Sharma Sunil kumar, 2008) [9]

The whole system was developed to attain the highest state of 'chitta'or consciousness where everything is merged into absolute consciousness. Patanjali- the father of yoga-has explained eightfold system of yoga to advance oneself on the spiritual path while hata-yoga explored the bodily postures-Asanas as well as Pranayamas, to prepare oneself for the higher yogic practices like dharana, dhyana, Samadhi. (Gore M.M., 1984) [6]

Chakrasna is known as wheel posture in English. As body takes round or near to shape like a chakra (wheel) in this posture so this posture is named as Chakrasana. In this posture all the 33 vertebrae are stretched backward. Body weight falls on hands and toes even the heels are lifted up.

All the stomach and chest muscles are stretched. Small and large intestine are stretched. All the spinal chakras are benefited.

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Maximum number of nerves gets involved in stretching and is benefited. (Sharma Sunil kumar, 2008) [9]

Procedure

Selection of Subjects

Ten male students from Jiwaji University, Gwalior were selected as the subjects for the present study. Since the subjects had been undergoing training for a considerable period, therefore it was considered that subjects possess reasonable level of technique of Chakrasana. Their age ranged between 20 ± 2 years. The subjects were explained about the objectives of the study.

Selection of variables

For the kinematic analysis of Chakrasana, following kinematic variables were selected:

a) Linear kinematic variables chakrasana in Yoga

- Height of center of gravity at the time of final pose.
- Distance between hand and foot during final phase.

b) Angular kinematic variables of chakrasana in Yoga

- Angle at right shoulder joint
- Angle at the elbow joint
- Angle at the wrist joint
- Angle at right ankle joint
- Angle at right knee joint
- Angle at right hip joint

Criterion Measures

The performance of chakrasana of each selected subject was taken as the criterion measure for the purpose of present study. The performance was recorded on the basis of execution of the skill. This was evaluated by 3 judges during final phase.

- The angle at selected joint was recorded in nearest degree.

Filming protocol and Analysis of the Film

Sequential photography was employed in order to register the

technique of chakrasana in yoga. The subject was photographed in sagittal plane. The camera being used at sagittal plane for the purpose was Canon- EOS T3, a motor driven camera, with the frequency of 30 frames per second. After video recording the CD was played with the help of computer and final position of each selected phase were obtain on the screen by trial and error method and kept in pause. Further the 'Elgon' of final pose was converted in photographs & recorded on transparency by the joint point method for all selected subjects. The centre of gravity each body segment and the whole body were determine by segmentation method as suggested by James g. Hay. The angles at various joints were also determined. The step wise procedure has been presented as follows.

Statistical Procedure

To find out the relationship between selected biomechanical variables and performance of chakrasana in yoga, Statistical Package for Social Science (SPSS) version 20 was used. For testing hypothesis the level of significance was set at 0.05 level.

Results

Table 1: Relationship of Selected Angular Kinematic Variables with The Performance of chakrasana in yoga at the Moment execution

S. No.	Variables	Coefficient of Correlation (r)
1.	Shoulder joint (Right)	0.102
2.	Hip Joint (Right)	-0.545
3.	Knee Joint (Right)	-0.196
4	Ankle Joint (Right)	-0.533
5	Elbow Joint (Right)	-0.086
6.	Wrist Joint (Right)	0.548

Significant at 0.05 level

Since the required value of coefficient correlation for 8 degree of freedom to be significant at 0.05 level is 0.632 and the obtained values were less than that, therefore, none of the selected angular kinematic variables at selected moment have exhibited significant relationship with the performance of subjects in chakrasana.

Table 2: Relationship of Selected Linear Kinematic Variables with the Performance of chakrasana in yoga at the Moment execution

S. No.	Variables	Coefficient of Correlation (r)
1.	Height of Center of Gravity of subjects	-0.447
2.	Distance between hand and foot	-0.9900

Significant at 0.05 level

As shown in Table 2 the obtained value of correlation ($r=0.632$) for 8 degree of freedom, only distance between hand and foot at moment execution of the subjects was greater than the required value of 0.632 at 0.05 level of significance. However, the obtained value of coefficient of correlations in other variable was less than the required value at selected level of significance, therefore, the distance between hand and foot at moment execution have shown negatively significant relationship with the performance of subjects.

Discussion and Conclusion

As shown by the Table 1 and 2 that the only one variable i.e. the distance between hand and foot of the subjects at moment execution, exhibited a negative significant relationship at the selected level of 0.05. This means that while doing Chakrasana lesser the distance between hand and foot at moment execution of the subjects better will be the

performance.

However, angular kinematic variables i.e., ankle joint (right), Knee Joint (right), Hip Joint (right), Shoulder Joint (right), Elbow Joint (right), Wrist Joint (Right) were found insignificant, but this trend does not mean that the angles at different joint at selected moments do not play any important role while executing or performing chakrasana.

In case of linear kinematic variable i.e. height of center of gravity of the subjects from the ground did not show significant relationships. As in this study the researcher was only confined to the relationship of height of C.G. at selected moments with the performance of subject in Chakrasana but significant relationship may be obtained by studying the path or displacement of C.G. in whole movement.

On the whole it may be ascertained that the low value of coefficient of correlation shown by the selected variables does not mean that these variables are not contributing to the

performance of subjects in chakrasana. The insignificant value of coefficient of correlations of these variables with the performance may be due to small size and non availability of sophisticated equipments.

The result of the study have shown that only in case of distance between hand and foot at moment execution of the subjects had shown a significant relationship with the performance of Chakrasana while other selected kinematic variables have shown the insignificant relationship with the performance of subjects in chakrasana.

Based on the analysis and within the limitations of present study, it was concluded that:

1. The lesser the distance between hand and foot at moment execution of the students, better will be performance of yoga students in Chakrasana.
2. The other selected variables such as ankle joint (right), knee joint (right), hip joint (right), wrist joint (right), elbow joint (right), shoulder joint (right) do not have significant relationship with the performance of yoga students in chakrasana.

Recommendations

Based on the conclusion, drawn in this study, the following recommendations have been made:

1. The variables such as different angles and center of gravity may be kept in mind as the factor contributing to performance of individual in yoga.
2. Similar study can also be conducted on female yogis.
3. The results of this study may be helpful in preparing a model of chakrasana in yoga.
4. The results of this study may help the coaches and researcher to evaluate the performance of subject in yoga.
5. The individual can make self assessment with the result of the study.
6. Similar study may be undertaken to analysis other asana techniques in yoga.

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