Influence of abdominal muscle recruitment while subjects go for squatting position toilet (Indian toilet) and sitting position toilet (Western toilet) as their daily habit during defecation process-An EMG Study

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BACKGROUND

The objectives of this research study were to investigate whether the abdominal muscles i.e. lower rectus, external oblique and internal oblique are influenced by EMG activity by applying defecations force on sitting position toilet and squatting position toilets performed by normal subjects. Squatting position toilet has a subsitential impact on various systems of the body and abdominal muscles are one of the major among them.

METHODOLOGY

30 subjects were involved in the study by convenient sampling method i.e. 24 females and 6 males aged 18 to 66 years (mean age=42 years) after the written informed consent. 15 subjects were using sitting position toilet and 15 were using squatting position toilet. The EMG analyses of all the subjects were done for lower rectus, external oblique and internal oblique muscles in their respective toileting positions.

RESULTS:- The analysis of data showed significant difference (p value 0.0412)(t value 2.140) on external oblique muscle and lower rectus (t value 2.414)(p 0.0226 value) recruitments between groups using squatting position as their habit as compared to sitting position where as no significant difference was found on lower rectus, internal oblique, external oblique between groups using sitting position toilet.

CONCLUSION:- Result indicated that squatting position predominantly recruited the external oblique and lower rectus muscle. The relatively low levels of the electromyography activity observed in sitting position toilet suggest that muscle recruitment is not likely sufficient in normal subjects.
KEYWORDS: sitting position toilet, squatting position toilet, EMG

INTRODUCTION: EMG as a tool for has been used since mid-1900 in study of muscle function in which both the normal muscle activity and affected muscle function has been checked by this method. Since, then both normal muscle activity and pathological muscle functions have been examined by this method. EMG has been mostly used for shoulder investigation and rehabilitation protocols whether in non operative cases or operative cases, in sports injury cases in coordination and analyzing shoulder muscle activity. In some of the medical conditions the electrical activity recorded on EMG of the muscle or nerves is not normal. Diagnosing the condition by finding the electrical properties in muscles and nerves.4

The act of eliminating faecal matter i.e. waste material in various forms from digestive tract via the anus is know as Defecation. The faecal matter moves from digestive tract to rectum via the waves of muscular contraction known as peristalsis in the walls of the colon. The food which is not digested may be expelled via this way in the process called ejection.5

Humans can eliminate the undigested food through two defecation postures i.e. squatting defecation posture or Indian position toileting and sitting defecation posture or western position toileting. The squatting position toilet is mostly used in rural population among illiterate where there is non availability of toilet seats. Among the both western toilet is most widely available nowadays due to lifestyle changes in developing countries. The sitting defecation posture is when a person forward leans with a 90 degree posture. Basically what type of position chosen for defecation is a individual decision and in which type of population person is living. As this may effect certain health conditions such as defecation syncope which is a serious medical health condition .The type of position chosen for toilet is also directly proportional to urination.6

Sitting position is when a person sits on a chair or stool with back support, with nearly 90 degree angle of hips and knee. Similarly, sitting position toilets are being designed. Western toilets are nowadays being designed as a person is assuming a comfortable sitting posture.7 this position is mostly used in developed countries as compared to developing countries. Development of toilets begins in nineteenth century with its widespread use.

One may feel more comfortable in sitting position toilet as it decreases the strains in lower limb specially in thigh region, knee joint, ankle joint and lower back as well. Breathing is also more easier in this position compared to squatting. Secondly, this position helps to maintain privacy of genital organs and good hygiene as clothes are not getting contaminated in this position. But this position has certain drawbacks also such as decreasing the anorectal angle by which certain people feel difficulty in passing out the fecal matter and feels obstruction. This posture also causes to repeat Valsalva maneuver by increasing the intraabdominal pressure which puts a lot of burden on cardiovascular system.12 Sikirov also published in 2004 study in which he
compared the length of time needed to defecate using various postures and concluded that the sitting defecation posture requires “excessive expulsive effort and time compared to the squatting posture”.

The squatting defecation posture involves squatting by standing with knees and hips sharply bent and the buttocks suspended near the ground. Squat toilets are designed to facilitate this posture. It is more widespread in the developing countries than that in the developed countries.

There are certain benefits of squatting position. Firstly, it makes the defecation or the elimination process more faster, easier and complete. Secondly, it helps in prevention of the fecal stagnation which is one of the main cause for causing colon cancer, inflammation of appendix and inflammatory bowel disease. Thirdly, it prevents the overstretching and damage of the nerves that control the prostate, bladder and uterus. Fourthly, it seal the ileocecal valve, between the colon and the small intestine. Fifthly, to maintain continence it relaxes the puborectalis muscle which is responsible to cause choking to the rectum. Sixthly, this position supports the colon and prevent straining by use of the thighs as recurrent straining can cause hernias and pelvic organ prolapse in other genders. For pregnant women, this position is excellent as it decreases the pressure on the uterus and daily squatting helps prepare one for a more natural delivery and increases the strength of lower limb also.

**NEED OF STUDY:** Nowadays, most of the people are facing bladder and bowel problems such as constipation, hemorrhoid’s etc. to overcome this they go for medical management. No one puts attention towards the recruitment of the abdominal muscles. Finding of this study will help us in enlightening the medical community as well as normal peoples in knowing the importance of muscle recruitment during defecation positions.

3. MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN

This was an observational study. In this study observation was taken with the help of EMG to see the effect of abdominal muscle recruitment on both males and females (who were normal subjects) while squatting on Indian and sitting on western toilets.

3.2 STUDY SETTING

Study was performed in the outpatient department of physiotherapy of lovely professional university Phagwara Punjab.

3.3 POPULATION AND SAMPLING

Subjects coming to OPD of physiotherapy department of Lovely Professional University, Punjab is the population of the study.30 subjects ranging from 17 to 66 years of age with male: female
(1:4) ratio was selected. Their demographic profile and medical history were obtained from their individual interview.

Sample of 30 subjects who fulfilled the inclusion and exclusion criteria were conveniently assigned.

3.4. PROCEDURE

Firstly, subjects for the study were selected according to the inclusion and exclusion criteria then procedure of the study was explained to the subject. If subject were willing to participate then consent form was signed by subjects. After this complete assessment of the patients was taken to rule out any pathology or abnormality.

Then two groups for the study were assigned:-

Group A:- Subjects who use only Indian toilet as their daily habit but same subjects were told to use western toilet also.

Group B:- Subjects who use only western toilet position as their daily habit but same were told to use Indian toilet also,

Then procedure of the study was explained to the subjects. Before going to EMG analysis subjects abdominal hairs was shaved to reduce the resistance. Then subjects were told to expose their abdomen until xiphoid process to pubic symphysis and lie on couch. Then electrodes were placed according to their required placement on muscles one by one starting from lower rectus, external oblique and then Internal oblique with ultrasonic gel. They were placed secured with the help of micro pore tape in the meantime EMG machine was set to working mode to note down the amplitude of the muscles. Before the beginning of the procedure experimental lab was made calm and noiseless and care was taken so that no artifacts take place.

Group A subjects were told to go from lying on couch to standing position. Then they were told to go for squat on ground as assuming that he is using Indian toilet and then apply defecation force, while subject applies the force recording were taken on EMG. Similarly, subjects were told to sit on western toilet and apply defecation force then again recording are taken on EMG.

Similarly, like group a, Group b subjects were told to first sit on western toilet and then apply defecation force, after this EMG reading were recorded. Then same subject were told to squat on ground as assuming Indian toilet and then EMG Readings were recorded.

After this adhesive tapes were removed and then electrodes. The skin and electrodes was cleaned with cotton. Then on EMG graph we mark the amplitude and latency of the required muscle and last we note the reading.
4. STATISTICAL TOOLS: Statistics were performed by using SPSS 16 and excel 2007. Results were calculated by using 0.005 level of significance.

5. RESULT ANALYSIS:

<table>
<thead>
<tr>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Position</td>
<td>Western Position</td>
</tr>
<tr>
<td>Mean</td>
<td>Mean Difference</td>
</tr>
<tr>
<td>194.64</td>
<td>41.20</td>
</tr>
<tr>
<td>Mean Difference</td>
<td>1.26</td>
</tr>
<tr>
<td>S.D.</td>
<td>Unpaired T Test</td>
</tr>
<tr>
<td>50.787</td>
<td>2.414</td>
</tr>
<tr>
<td>Mean Difference</td>
<td>P Value</td>
</tr>
<tr>
<td>5.81</td>
<td>0.0226</td>
</tr>
<tr>
<td>Table Value at 0.05</td>
<td>2.05</td>
</tr>
<tr>
<td>Result</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

Table 1: a) This table shows the Mean, SD, Mean difference, T test and P value for Group A for Indian position and Western position.

b) For Group B Mean, Mean difference, SD, T Test and P value for western position and Indian position.
<table>
<thead>
<tr>
<th>S.D.</th>
<th>85.853</th>
<th>37.681</th>
<th>86.819</th>
<th>60.758</th>
</tr>
</thead>
<tbody>
<tr>
<td>P Value</td>
<td>0.0412</td>
<td></td>
<td>0.2206</td>
<td></td>
</tr>
<tr>
<td>Table Value at 0.05</td>
<td>2.05</td>
<td></td>
<td>2.05</td>
<td></td>
</tr>
<tr>
<td>Result</td>
<td>Significant</td>
<td></td>
<td>Not Significant</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2:**

a) This Table shows the Mean, Mean difference, SD, T value and P value for Group A for Indian position and western position.

b) For Group B the Mean, Mean difference, SD, T value and P value for Group A for Western position and Indian position.

<table>
<thead>
<tr>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Position</td>
<td>Western Position</td>
</tr>
<tr>
<td>Mean</td>
<td>160.98</td>
</tr>
<tr>
<td>Mean Difference</td>
<td>15.39</td>
</tr>
<tr>
<td>S.D.</td>
<td>133.490</td>
</tr>
<tr>
<td>Unpaired T Test</td>
<td>0.426</td>
</tr>
<tr>
<td>P value</td>
<td>0.6735</td>
</tr>
<tr>
<td>Table Value at 0.05</td>
<td>2.05</td>
</tr>
<tr>
<td>Result</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>
Table 3: a) This table shows the mean, SD for group A for Indian position and western position with mean difference and t value

B) For Group B Mean and SD for western position and Indian position along with mean difference and t value.

6. DISCUSSION: This was the first trial to use EMG analysis of abdominal muscle on two different position during toileting i.e. Indian position (squatting position) and western position (sitting position). Before this no such experimental study has been done to note the recruitment of abdominal muscle in these two positions.

As we all know GIT problems such as constipation, hemorrhoids’ etc. are very prevalent nowadays among the western countries and among the white peoples as compared to white population. They are resulting in various muscular, cardiovascular and neurological conditions. Although these medical conditions are treated by various drugs, laxatives and surgeries but purpose of this study was beyond these levels working at the primary level.

The aim of the current study was to check the influence of Indian toilet and western toilet on abdominal muscle recruitment. In the present study it was hypothesized that there exists a significant change in the amplitude of lower rectus, external oblique and internal oblique muscle while using both types of toilet as their habit on EMG. According to the maximum recruitment of muscles in particular position we will recommend that toileting position which will be very effective in decreasing the incidence of GIT problems.

The present study results show that benefits of using squatting position toilet is not only limited to decreasing the incidence of GIT problems. Rather it is very helpful position for strengthening and stretching of lower limb muscles specially quadriceps and hamstrings as they work eccentrically. Squatting position is even very beneficial for pregnant ladies because it makes them more prepared for normal delivery as compared to caesarean delivery by increasing the birth canal. Abdominals are working isometrically in this position.

7. LIMITATIONS: There are certain limitations of the study such as sample size was small. Actual defecation process not taken. Lower limb EMG was not done. EMG pelvic floor muscle and lower back muscles not done. EMG on these two positions with OA knee patients not done. EMG on actual GIT patients not done.

8. FUTURE SCOPE OF THE STUDY: This study will be very beneficial in decreasing the prevalence of GIT problems such as constipation, hemorrhoid’s, diverticulosis, hiatus hernia, colon cancer etc. Even squatting position toilet will be very beneficial for pregnant ladies to get prepared for normal delivery instead of caesarean section. Strength of lower limb muscles will automatically increase by this small effort.
9. CONCLUSION:- Based on the analysis of data it can be interpreted that squatting position produces significant recruitment in correlating with the literature and statistical analysis. This study showed that Indian toilet had produced significant recruitment studies of abdominal muscles i.e. lower rectus and external oblique as compared to the sitting position.

Present study concluded that squatting position is an effective position in recruitment of abdominal muscles when compared to sitting position toilet, which makes this position more clinically feasible

Conflict Of Interest :- None

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