Analysis of the Influence of Inadequate Postures in Dort Acquirement Using OCRA

Romero Cardoso Oliveira[*], Francisco Soares Másculo[*], Ângela Regina Poletto[+]

[*] Production and Systems Department, School of Engineering, Paraíba Federal University , Brazil
[+] Santa Catarina Federal Institute, Florianópolis – SC, Brazil

Email: romero.coliveira@gmail.com; masculo@gmail.com; angelapoletto@ifsc.edu.br

Abstract

The objective of the study was to verify the relationship among the use of inadequate postures through the method Occupational Repetitive Actions, OCRA, and the generation of Repetitive Strain Injuries, RSI, in workstations of repetitive work. The proposed study is of exploratory and descriptive nature, with quali-quantitative approach and was done in a company of the shoe sector. It was verified the quantitative of RSI, as well as, the situation of the repetitiveness in the workstation through the method OCRA, collecting data and deepening the knowledge on the influence and importance of the repetitiveness in this company. The results show the discrepancy among the data picked by OCRA and the numbers of RSI registered in the medical department of the appraised company. It is known about the importance of OCRA as a validated method and globally used, however it is difficult the compilation of theoretical data for the generation of an index that detects the danger of a specific work in provoking lesions.

Keywords: Method OCRA; postures inadequate, Repetitive Strain Injury.

1 Introduction

The work environment is a space that includes ergonomic variables, in the areas physical, cognitive or organizational, that if not observed can influence the performance and the worker's labor capacity directly. The posture or the positioning of the parts of the body are of fundamental importance for the biomechanics of the movements, the body positioning when very adjusted will provoke the execution of correct postures without overload in the body structures. When not positioned in a correct way it may causes the execution of forced postures, that will take interference in the movements during the accomplishment of the task, worsening the action of the harmful aspects on the body parts.

In the last years the discussions on diseases related to the work took impulse, because these can lead to the worker's incapacity temporary or permanent, not just bringing negative consequences for this, but also for the company or institution where they work (NECKEL; FERRETO, 2006). Many problems are related to the generation of RSI, and one of the principal is the high repetitiveness level and execution of the goals which the workers are exposed.

However, some companies didn't still go back their concerns to the workers, putting for the society the consequences of an atmosphere of work harmful and exempting themselves of the improvement obligation in the productive processes, in the organization of the work and in the relationship with the worker, that would be possible solutions for the decrease of the occupational risks (PASTRE, 2001). Salim (2003) affirms that in spite of being countless the factors that influence the genesis of the occupational disturbances, "its determination, ultimately, surpasses the social structure, relating, above all, with the changes in course in the organization of the work and secondarily with the peculiar technological innovations to the productive restructuring".

In this manner, we see the relevance of the analysis of the repetitiveness of the work as primordial factor in the prevention of RSI, and as a main point in the improvement of the work conditions, and consequently, influential in the productivity of the company. For evaluation of the work conditions in the companies, or in any it labor workplace, a lot of methods of analysis of the rhythm and work load are

available in the ergonomics area. The method of evaluation OCRA is an important instrument and validated and recognized for evaluation of the level of repetitiveness of the tasks, generating an index of risk level for acquisition of occupational diseases.

In this sense it is noticed the importance of the analysis of the work with respect to the generation of occupational damages, and methods that aid are of great importance. In the practical experience using the method OCRA was noticed variability in the importance or weight of some aspects on other in the final index, however it is plausible that some factors provoke more physical stress than others on the body structures. Then it is looked for inside in this work the observance of the method OCRA of these variability and if these are in agreement with the real factors of generation of RSI that will be analyzed in the research.

This study contributes to systematize the generating aspects of RSI, what facilitates the prevention and the combat to these occupational damages, as well as it aids to the construction of workstations proactive that avoid the use of these harmful factors during the execution of the tasks. The portal of Brazilian Social Welfare shows the concern with the great number of cases of RSI, which increased 126% between 2006 and 2007, from 9.845 cases in 2006 to 22.217 cases in 2007. It is considered that, in 2009, the government spent around 2 billion of reals with the cases of RSI in Brazil.

For the observance of RSI in a worker is known that the genesis can come from several aspects. This research will focus in the use of forced or inadequate postures for the execution of the tasks, which is an item of fundamental importance, because the posture has direct influence on the incidence of vectors of force harmful on the body structures, and that consequently, can generate occupational damages.

This study tries to answer the following inquiry: which is the existent relationship among harmful postures observe through OCRA in the work place and the diagnosis of RSI, in these work places?

The object of research of this work was the shoe industry, where in which important characteristics were observed, as the accomplishment of a lot of tasks in handmade way, development of activities in cells of production with specialized tasks, accomplishment of the activity in high-speed and small cycles. All these data and numbers show the relevance of the approached subject and the need of studies that look for the progress of the diagnosis and characterization of the occupational diseases, for consequently they aid in the decrease of the number of these lesions.

The objective of the study was to verify the relationship among the use of inadequate postures through OCRA and the generation of RSI in work repetitive.

2 Method

The proposed study is of exploratory and descriptive nature, with quali-quantitative approach and was done in a shoe company, it was verify the quantitative of RSI, as well as, the situation of the repetitiveness in the workplace through the method OCRA, collecting data and deepening the knowledge on the influence and importance of the repetitiveness in this company.

The universe of the research was this company, it was included in the study two branches in the Paraíba State of the company, where samples of the repetitive workstations were analyzed, of the productive sections of the company. The selection of the sample it was non probabilistic, looking for to assist the pré-established criterion in the research, that it was the visualization, through the accompaniment of the activity, of a repetitive cycle in the execution of the task.

The collection of data was through the analysis of the workstations of repetitive works of the company, as well as the collection of the cases of RSI of this referred company. It is understood as workstation with repetitive character all those activities with a cyclical characteristic in the execution of the activity, that can be observed by the accompaniment of the activity and for the measurement of the activity cycle.

The contact with the company was through a consulting contract where the data were picked in this period, for two researchers in a total of 3 months. The parameters designated for the collection of data of the research brought us the analysis of 73 workstations with a defined task cycle. This filter of the workstations was done through the observation of each task in the amount of employees of the company, of the assembly sections, cut, sews, finishing, among other, observing or not the presence of a defined cycle in the accomplishment of the work.

The method Occupational Repetitive Actions (OCRA), developed by researchers Enrico Occhipinti, Daniela Colombini and Michele Fanti, it is an evaluation method and analysis of the risk factors associated to repetitive movements of superior members, through the calculation of a quantitative index (PAVANI, 2007; ANTONIO, 2003). This characteristic of the execution of a certain cycle is essential for the application of OCRA, and important condition in the emergence of RSI. And for the research of the data of RSI, the medical department of the company was contacted, being picked the data of work related musculoskeletal disorders (WMSD), through the report of notification of pathologies of superior members, related as lesions for repetitive efforts.

The method OCRA is a method of quantitative evaluation of the repetitiveness in work, it uses analysis of several points, as postures of superior members adopted during the task, force exercised in certain movements, duration of the cycle, number of actions accomplished by each superior member, among others. Each approached aspect is equal to a punctuation, which will be counted in the end through the observed technical actions (OTA) and recommended technical actions (RTA), whose division will give the final index that will indicate the risk presence for the generation of occupational diseases.

2.1 Data Analysis

The analysis of the data of the OCRA method, as well as of the RSIs data was described in a quali-quantitative way, describing the characteristics of the lesions and analyzing the behavior of these pathologies in the company.

In this sense the application of the method was done in workstations with repetitive characteristics, confirming or not the risk verified in that place. The data of the index posture of the instrument were analyzed verifying the quantitative of the presence of the forced/inadequate movements, for each articulation.

It was also picked data of RSI of the company, that served as reference for the analysis of the posture item of the method, where it was verified if the body structures of the superior members that more influences the value of OCRA are the really the more observed.

3 Results and Discussion

The study analyzed 73 workstations using the method OCRA. Just in a post the index multiplication posture had the value 1, which it is the best punctuation, in other words, only one workstation presented the execution of postures in forced amplitude that had no influenced the conditions in the index OCRA, and consequently, for the method, it doesn't influence the generation of RTIs.

As the analyses are accomplished differentiating the members, left and right, we will have 146 results of values of factor posture, where: 2 members obtained value 0,7; 41 members the value 0,6; 33 members with the value 0,5; 31 members inside of the punctuation range that generates the factor 0,33 and, finally, 16 members are with the factor in the value of 0,1.

On the members with result 0,7, it was observed that 3 only had the final index of OCRA in the range of high risk the generation of RSI, what shows the influence of the posture inside of the value OCRA, which only represented 13,04%. Among the 41 members with factor multiplier 0,6, 17 were very high with the risk of obtaining of RSI, that elevates the percentile value, in comparison with the previous factor, for 41,46% of the members.

Continuing the analysis for the verification of the value 0,5; 17 members of the 33 were shown to be in the range of high risk, revealing a percentile of 51,51%, confirming the tendency of influence of the factor posture in the final index OCRA. The factor 0,33 display clearly this tendency, since of the 31 members with this value, 23 are in the range of high risk, in other words, 74,19% of the superior members analyzed had serious risk of obtaining a lesion for repetitive effort.

The worst level found in the research, and that corroborates with the previous data, are of the members that are with the multiplication value in 0,1, where all the members are in the risk range, with the smallest value of the final index OCRA 8,32, that is more than the double of the inferior limit to be in this risk group.

Through this initial analysis it was intend to demonstrate the importance of the factor posture inside of the method used for the analysis, which it is observed inside by the practice and experience of the companies.

Still, from the results, it can be accomplished the analysis of the values of the final indexes OCRA, for both members. Then, the research obtained in the total, 146 results of the exposition index (EI), being 73 of each member. For the right member it was verified the existence of only 13 workers (17,81%) with the index inside of the acceptable level of EI, being 16 (21,92%) in the level of low risk of generation of RSI, and the great majority inside of the range of high risk for acquiring RSI, with 44 workers inside of this level, in other words, 60,27% of the sample accomplished for the right member. In the left member it was counted 23 workers inside EI of the normality range, what represents 31,51% of the number of analyzed individuals. In the range of low risk, 18 workers, representing the percentile level of 24,66%, and inside of the range of high risk, where again it was most of the sample, it came 32 individuals, showing that 43,83% of the workers presented great risk of acquiring RSI.

With these results, it is noticed the largest gravity of the right member in the exhibition to factor of risk, what can be explained by most of the population to be skillful and to use this with more frequency in the activities of more precision or force. In the general analysis it was verified that out of the 146 results of the two members, 36 were in the normality range, 34 in the range of low risk and 76 in the range of high risk. In other words, 75,34% of EI for member presented risk of developing pathologies in the work for repetition, and 52,05% of the total offered high risk for the development of these diseases.

The analysis of the work cycle showed that the average of the repetitive cycle of execution of the tasks was in 0,36 minutes, or 21,6 seconds, where the smallest value of duration of the cycle was in 0,05 minutes or 3 seconds, what showed the high index of repetition of the movements that the workers were exposed in a lot of tasks, that provokes constant waste of the same body structures, and probably, lesions.

These values show the impact of the repetitiveness inside of the analyzed company, in the sense of futures problems with relation to the workers' health, and in consequence, of financial and human damages for the researched industry.

3.1 Analysis of the results of the OCRA Postural Index

The factor posture includes specific movements in exaggerated ranges of the superior member, and the types of grip, for the formulation of its punctuation. In the shoulder the abduction movements and flexion are specified, with more than 80 degrees of range of movement articulation, abduction, with range from 45 to 80 degrees and extension with more than 20 degrees.

In the elbow it is take in consideration the supination movements, pronation, flexion and extension, all if superior to 60 degrees. And, finally, the wrist, with the movements of radial deviation (more than 15 degrees) or ulnar (more than 20 degrees), flexion and extension (these two with more than 45 degrees). The types of grips considered for the method are: area of the hold broad, area of hold narrow, hold in tweezers, hold palmar, hook hold and movement of the fingers.

The results of the shoulder area of the item posture of OCRA, shows the movements of the shoulder considered by OCRA, the data reveal that the abduction movement, between 45 and 80 degrees, is

present in 22 of the 73 analyzed workers, for the left member, and 27 for the right member. This display a presence of 30,14% and 36,99%, respectively for left and right member, of forced range of the abduction movement, in more than 50% of the cycle of the task.

The flexion movement or abduction for more than 80 degrees are present in 30 workers of both members, what represents 41,10% of the analyzed workers. This display an accentuated presence, of a movement of great biomechanics load on the muscles and articulated structures involved in the execution of this movement, since it is necessary use of great force to win the torque imposed by the weight of the arm.

Already the movement of extension of the shoulder, which is in the daily movements little executed, it is also shown little used in the accomplishment of the tasks, with presence in only two analyzed activities, for each member. This represents only 2,74% of the analyzed tasks, what shows the small contribution of this movement in the biomechanics of the shoulder, and mainly, in the generation of occupational damages.

From the general analysis of the movements of the compound of the shoulder it was shown that the right member was more affected just in the abduction, from 45 to 80 degrees, with a small margin. This also happens due to function of the shoulder of aiding in the biomechanics of the movements of the arm and wrist, and for that, there is not the exaggerating unilateral use on the right side, what can happen in the other areas of the superior member, involved directly in the execution of the specific movements for the accomplishment of the tasks. In other words, even with the larger probable presence of exaggerating movements on the right side in wrist, this doesn't happen in the shoulder, because the left hand, in the case of most of the skillful ones, it is almost always used as support and aid in the activity, and this demands the movement of the shoulder, mainly in abduction.

The exaggerating movements of the elbow, the supination movement was present in 20 of the 73 activities analyzed for the left member, and only 8 for the right member. This represents 27,38% of the samples of the left member (LM) and 10,96% of right member (RM). This difference can be explained since the supination movement, which is that in that the arm "rotates" leaving the palm of the hand upward, it was visualized mainly to hold the work material, while the other member, in the case of the right-handed, executes the main task of the activity.

The pronation movement, was quite visualized, having been detected in 45 (61,64%) samples of the LM and 56 (76,71%) of RM. This movement is present in great scale in the execution of the tasks, and this factor can be understood due to the importance biomechanics of this movement for the earnings of force in the movements of the wrist. And as the movements of the wrist are essential in the observed activities, since these are basically manual, the posture of semi-pronation of the forearm was quite detected. It is important to observe that both members executed this posture, since even in the support member, there is the total movement of the forearm from supine to the prone, in the cases in that there is supination, for complete visualization of the used material, or position maintained in prone to hold the material, however these are not the postures more adopted.

The movement of flexo-extension of the elbow, in these cases represented almost exclusively for the flexion, it was present in 69 and 70 of the samples analyzed for left and right members, respectively, what shows a percentile value of 94,52% and 95,89%. This solid presence of this movement is clearly view in the real practice, because the accomplishment of the activities in the tables forces the isometric flexion of the elbows, in practically all the activities. Rarely it is seen a task being accomplished with the extended arms, what reduces the precision of the fine movements, due to distance of the necessary visual contact.

In the area of the wrist, it is observed the presence of radial or ulnar deviation in the task in 22 of the 73 cases, for each member, of this movement, in other words, 30,14% of the activities demanded the execution of these movements. This equality of laterality in the presence of these movements can be understood, because these movements, mainly the ulnar deviation, are necessary for the handling of the material for the hand, facilitating the prehension of the object, as well as in the execution of the task, as important movement in the biomechanics of the wrist, increasing the force of muscles of the hand.

However there are not only the deviations that influence the muscular biomechanics of the area wrist-hand, the movement of extension and flexion it is also important in the earnings of muscular force. The extension provides a biomechanical gain larger than the flexion. Therefore it is constantly verified this movement in the dynamics of the movements of the work.

In the case of this research, the extension was found in 31 (42,47%) of the 73 researched, for the left member, and 33 (45,21%) for RM. However, the wrist flexion was present in 12 (16,44%) of those researched, for the LM, and 14 (19,18%) for RM. These movements are less present than the elbow movements, and in proportion similar to the one of shoulder, showing the importance of the compound of the arm-elbow-forearm as support area and transmission of force for the accomplishment of the movements of the wrist.

The types of grip also count for the score of the factor posture and they are important, because they will contribute with the application of force for the hands, or even in the case of the item " movement of the fingers " for the use of additional repetitive movements the execution of the movements of the main task. With that, the execution of the broad hold was the more visualized during the research, being present in 36 workers with the left hand and in 32 with the right. This display a majority occupation of the left hand with this type of hold, therefore in this situation the hand of execution of necessary and fine movements, in the right-handed ones, is free for the execution of the main movement of the task.

The narrow hold was seen in 11 samples of the left hand and 23 of the right hand, what shows an inversion in the use of the left hand for right, in comparison with broad hold, for most of the workers, what might have happened, due to this type of catches to be more necessary, needing the use on the commanding body side. The hold in tweezers, that is more specialized than the narrow, and it also happens more in the right hand, in 17 cases, against 11 of the left hand.

With the palmar hold, the situation again is inverted, since in the same way, this hold is ruder, happening 22 times with the left hand and 18 with the right. The hold in hook was practically inexistent in the collected samples, being in only 2 cases, one for each hand, left and right. The movements of the fingers were seen in 13 cases for the LM and 11 for to RM, where in all these cases it was almost noticed the bilateralism of the movement, in other words, and both hands were executing the same movement, in the same task.

3.2 Analysis of repetitive Strain Injuries Data

There were collected in the company, during the years of 2010 and 2011, the cases of RSI of the superior members, for affected area, in other words, wrist/hand, arm/elbow/forearm or shoulder. In the total there were detected, in this period, 181 cases of RSI related to the workstations analyzed by OCRA, in other words, all the cases of RSI here sampled assisted in the work activities analyzed in the repetitiveness research. Out of the 181 cases of RSI found, 92 cases were related to lesions in the area wrist/hand, 28 to the compound arm/elbow/forearm and 61 the area of the shoulder. The cases of lesions in the wrist represented 50,83% of the cases of RSI found for the superior members, showing the importance of this area in the execution of the movements for working, in repetitive exercises, of precision, and a lot of times with application of force.

The compound of the shoulder followed the wrist in number of cases of diagnosed RSI, with 33,70% of the cases. This area, of larger muscular capacity and application of force, always needs, when moving the superior member, to win a great lever, when supporting the whole weight of the member, overloading, like this, its structures and leading to lesions.

The area arm/elbow/forearm had the smallest number of diagnosed lesions, with only 15,47% of the cases. This area, for being in the middle of the other two mentioned areas, is quite used in the activities of work, however it is not related to movements fine, nor repetitive, and it doesn't also have relationship with great applications of force. Therefore, it is not observed a lot of work pathologies associated to this complex.

Different pathologies were diagnosed, all with relationship reports with the work related musculoskeletal disorders, and these are placed in the Table 1. It is verified great frequency to Carpal Syndrome Tunnel, that it is basically the compression of the medium nerve, provoking sensibility loss and pain in areas of the hand. However the more known RSI, and also very present in the research, is the tendonitis, that is the inflammation of the tendon and that it was detected in 68 cases, represented mainly by the wrist and shoulder tendonitis.

Table 1: Repetitive Strain Injuries related cases in the company

Types of WMSD found between 2010 and 2011	N
Carpal tunnel syndrome	52
Wrist/hand tendonitis	27
Wrist/hand Bursitis	1
Wrist Synovitis	4
Wrist/hand tenosynovitis	5
Quervain's syndrome	3
Lateral epicondylitis	9
MediaL epicondylitis	3
Elbow tendonitis	5
Bicipital tendonitis	11
Shoulder bursitis	8
Calcifying tendonitis of the shoulder	14
Shoulder impingement syndrome	7
Rotator cuff syndrome	4
Shoulder tendonitis	25
Cervicobrachial syndrome	2
Shoulder synovitis	1

The epicondylitis, that are inflammations in the epicondylis (bony structures in the medial and lateral sides of the elbow) and that are very present in athletes, they were also detected in the research, probably in combined repetitive activities with application of force, as the act of hammering.

3.3 Comparison of OCRA Postures and RSI Data

The results of the observation of the postures in the workstations, when the OCRA was applied, showed a great presence of the movements of the elbow, with significant difference for the shoulder movements and wrist. Accomplishing an average of all the movements of each articulation, a presence of 61,18% of the harmful movements of elbow in the execution of the analyzed workers' task. In other words, for a reach of 100% in this point, all the workers would have accomplished all the forced movements in both members, however, in this case, little more than 61% of the possible harmful movements were executed. For the articulation of the shoulder the value decreases to the half of the value of the elbow, for 30,59%, followed by the wrist with 25,80%.

Table 2: Comparison posture inadequate and % of RSI

	% Inadequate Posture	% RSI
Wrist	25,8	50,83
Elbow	61,18	33,7
Shoulder	30,59	15,47

The data of RSI already picked in the company, in the Table 2 show the area of the wrist with 50,83% of the cases of RSI found for the superior members, the compound of the shoulder with 33,70% of the cases and the area of the elbow with 15,47%. Comparatively, as it is seen in the table 2, there is a disparity in the percentage of forced postures found in the execution of the activity and I number of diagnosed RSIs.

These data show that the observation, purely, of the accomplishment of the same posture in more than 50% of the work cycle don't contemplate in the generation of RSI in that body structure. In the most symbolic case than we can see that, it is the area of the elbow, where the great presence of movements accomplished in more than 50% of the cycle were observed, however this didn't reflect in most of the cases of RSI, because it is seen that the principal observed movement is, in almost all the cases, exercised in isometric contraction. This is a contraction type with tiring characteristic, however there is not movement to articulate, not accomplishing attrition among the component structures of the compound, and consequently, not forcing the waste and not provoking lesions.

In the case of the wrist the opposite is observed, where the same movement a lot of times it is not visualized in more than 50% of the cycle, since there is a larger combination of movements in this area during the accomplishment of the activity, however the accomplished exercises are with speed and forces many higher times than in the other areas, provoking the constant attrition of the structures of the area of the wrist, causing waste and, hereafter, lesions.

In the area of the shoulder, a big number of lesions was not also detected, which in this case, it would be waited, because the observed activities are in great majority of tables, without shipment of great weights, or need of flexo-abduction of the shoulder with weight rising, whose movement is associated to the emergence of lesions in the compound of the shoulder.

For a necessary analysis of the importance of the forced movements in the generation of RSIs is necessary to consider other variables such as applied force, contraction type, and weight transportation, among others. The simple consideration of the presence of the movement in more than 50% of the cycle (except for the flexion movement or abduction of the shoulder the more than 80 degrees), doesn't really contemplate, basing on the collected data, the load imposed in the body structure, that suit the movement as harmful, influencing an index of level of repetitiveness risk.

4 Conclusion

The results show the discrepancy among the data picked by OCRA and the numbers of RSI registered in the medical section of the researched company. It is known about the importance of OCRA as an approved method and globally used, however it is difficult the compilation of theoretical data for the generation of an index that detects the danger of the activities in a workstation in provoking lesions.

It is understood that it was analyzed, in the results, just the factor posture, and that the method includes other aspects. However, starting from this point, it can be conclude that the analysis and punctuation of harmful movements should take in consideration other important requirements, and not just the presence of the movement in good part of the repetitive cycle.

The ergonomic analysis of a workstation is peculiar to that place, and methods that aid to this are very important job, knowing that these are coadjutant to the description and the appraiser's inspection, that it will analyze and it will end through the practical vision the gravity, or not, of the work for the risk of provoking a RSI.

The results appear inside for a larger importance of the factor posture of the evaluation method, including other evaluation criteria. The movements adopted in the workstation impose overloads biomechanics that can have an influence factor in the generation of larger TSI´s than observed in the tool.

It is comprehensible that the ergonomic analysis of a workstation, in the sense of analyzing the degree of risk of a work environment, is complex and it takes in consideration several factors that difficultly will be included in only one analysis tool. Therefore the importance of OCRA as an instrument that gets to join

several data, inside of analyzed parameters and tested by qualified professionals, and that supplies an important index, as parameter for an ergonomic diagnosis of the work position.

However, the need of researches is observed that deepen this theme about the generation of damages of work, and their causes and effects, which it is of great social and economical importance. This work intended to contribute for the increment of these studies, knowing that the pursuit of this diagnosis is important, with propositions of how to develop means that facilitate the posture analysis of a workstation, since this is a current theme and present in the reality of companies that are concerned about the negative influence of DORT´s.

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