

## Evaluation of Ergonomic and Biosafety Standards in Clinical Dental Practice

Ana de Lourdes Sá de Lira\* and Hélio Alves Nascimento

Department of Clinical Dentistry, Area of Integrated Clinic, School of Dentistry, Universidade Estadual do Piauí- UESPI, Parnaíba, PI, Brazil

\*Corresponding Author: Ana de Lourdes Sá de Lira, Department of Clinical Dentistry, Area of Integrated Clinic, School of Dentistry, Universidade Estadual do Piauí- UESPI, Parnaíba, PI, Brazil.

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### Abstract

**Aim:** Evaluate the perception of dental surgeons and academics of dentistry about ergonomic and biosafety standards.

**Methods:** Initially in T1, the questionnaire was applied to professionals (G1) and academics (G2) involved in the research, in order to analyze their perception about the biosafety and ergonomics standards in their clinical practice. Educational folders and banners about the importance of these standards were given and exposed in the participating institutions of the project. Six months later, in T2, the questionnaires were reapplied to investigate possible changes in the perception and habits of the study participants.

**Results:** When submitted to the test of Chi-square association there was a significant difference between G1 X G2, both in T1 and T2 about the ergonomics issues. There was no significant difference between the groups regarding biosafety issues in T1 or T2, not even between T1 and T2 for each group.

**Conclusion:** There were significant differences between G1 and G2 regarding knowledge about ergonomics standards. Ergonomic and biosafety standards are possible of being implemented by both groups. All were aware of the consequences of non-compliance of the norms. Both G1 and G2 know the risks that they are exposed to, but sometimes some of them do not comply with ergonomic and biosafety standards.

**Keywords:** Human Engineering; Exposure to Biological Agents; Personal Protective Equipment

### Introduction

Occupational Risks can be characterized as aggravating factors that can directly or indirectly affect the worker in his or her work environment. These risks may be related to the type of work or to the material, substances, processes or situations that cause accidents or diseases [1].

In dentistry, the fact that some professionals and academics do not comply with the necessary precautions regarding the biosafety and ergonomics norms makes them increasingly exposed to certain risks, which has contributed to increase the rate of cross-infection and diseases osteomuscular injuries, resulting in poor quality of care. Risk is defined as a biological, chemical, or physical condition that has the potential to cause harm to the worker, product, or environment [2].

The relationship between Ergonomics and Biosafety is undeniable. The two components complement each other by ensuring the health of the dental surgeon (SD) within their scope of work. Biosafety comprises a set of actions designed to prevent, control or eliminate risks inherent in activities that may interfere with or compromise quality of life, human health and the environment [3].

Ergonomics is a scientific discipline that studies human work and the basic principles provided for the organization of work. These principles, when applied to dental practice, provide dentists and academicians with a simplification of operative procedures [4].

The use of personal protective equipment (PPE) is intended to prevent microorganisms from patients, through blood, organic fluids, secretions and excretions, contaminate the health professional and his or her staff, as they are constantly exposed to the most occupational hazards and microorganisms, which can lead to diseases ranging from influenza to more severe diseases such as hepatitis and AIDS. The PPE's include gloves for each procedure, a waterproof apron, a cap, a mask and goggles, as well as ear protectors and radiological protection equipment [5].

Treating biosecurity is to analyze the risks to which life is subject, the main point being the protection of individual and collective health. However, the literature has shown that the degree of obedience of the professional to the protocols is variable, either for individual protection measures or for collective measures. In many cases they are mainly observed in the public service, the lack of working conditions and the great pressure for high productivity. This often leads to neglect of biosafety and ergonomic standards [4,5].

Factors such as high intensity and inflexibility of work postures, excessive repetitive movements at great speed, overload of certain muscular groups, absence of pauses and control over the way of work, besides the use of furniture and equipment outside the ergonomic standards, contribute for the increase in the incidence of musculoskeletal disorders related to work in different occupations [6].

Risks can lead to muscle disorders in the spinal region that cause pain, headache, painful nodules in the neck region. In addition, the SD or academic may suffer from inflammatory lesions in the group of Repetitive Strain Injuries (RSI) and Work-Related Musculoskeletal Disorders (DORT) such as tendinitis, tenosynovitis, synovitis, neuritis, carpal tunnel syndrome, myofascial syndrome, and circulatory diseases [7,8]. For this, attention is drawn to the need to establish, apply and supervise the work posture and intervals for pauses and stretches between clinical appointments [8].

The Ministry of Health, together with the National Health Surveillance Agency (ANVISA), have developed, improved and monitored the implementation of standards of care for patients in various health facilities, including dentistry [2]. Thus, it is the responsibility of managers, dental surgeons (SDs) and architects to meet the requirements of ergonomics and biosafety, not only to comply with bureaucratic matters, but also to avoid the danger of contamination, thus preserving the health of the entire team of practicing professionals as well as the population that is assisted [6].

Comparing the data on the equivalence of time of training and practice of dentistry, it was observed that more than half of the SDs practiced in the public sector for more than twenty years. The professionals spend a great deal of time experiencing work in the public sector, where they report not finding adequate equipment and work conditions [9,10].

Regarding biosafety, the risk of cross-infection in dental activity is worrying, and it is important that there is awareness of changes in the professional's behavior, so that these minimum safety measures are adopted in all treatment situations and for all patients. The dental office is a very favorable place for the professional and the dental academic to acquire some pathology in their respective work environments [11].

Thus, the present work was necessary, in an attempt to make the SDs and academics aware of how biosafety and ergonomics are found in dentistry. By being aware of the risks to which they are exposed and having the necessary structural resources, professionals will be able to take preventive action, with a view to improving the quality of life of the assisted population.

This study aimed to evaluate the perception of dental surgeons and academics about ergonomic and biosafety standards.

## Material and Method

The research followed the standards of Res. N° 466/12 (CNS / MS) and was approved by the Ethics and Research Committee of UESPI, with CAAE 55553615.0.0000.5209, and substantiated opinion N° 1,634,311. Ergonomics, biosafety and personal protective equipment were used as descriptors.

A survey of the Family Health Strategies (FHS) of the cities of Parnaíba and Luís Correia, both in the state of Piauí, was carried out with the Oral Health Team in full operation and the Clinical School of Dentistry (CSD) of the State University of Piauí (UESPI). Of a total of 32 SDs, 24 were included in the research that provided services to the ESF and wished to participate and all the scholars, totaling 33. Sixteen of the eighth and 17 of the tenth (last) periods of the dental course in the year 2015, due to being close to graduation, whose odd periods occur in the first semester and even periods in the second semester of each school year. Eight SDs that refused to participate in the study were excluded, as were the other professionals from the FHS and the CSD of UESPI.

It was a prospective and quantitative study, in which the questionnaire was applied to SDs (G1) and to dental academics (G2) with 12 questions of ergonomics and 15 questions of biosafety. The perception of the groups on these subjects, the frequency with which they comply with the norms, as well as the structural situation of the FHS and the CSD of UESPI were evaluated, with suggestions on what should be improved.

Prior to the execution of the research, the questionnaire, which was elaborated based on the ergonomic and biosafety standards of the authors Jorge [5] and Garbin., *et al.* [12], respectively, was applied to 15 UESPI dental academics, randomly chosen to calibrate the researcher. This, with the letter of presentation of UESPI, requested the authorization of the coordination of the Health Units and the Board of the University Campus for the development of the project. After this survey, he visited FHS in search of professionals willing to participate in the project. The same was done with the academics.

At the first moment, the Informed Consent Form (FCI) was given to be read and understood by the participant, in a reserved environment, respecting their privacy. Subsequently the questionnaire was applied to each participant, individually. The candidate had complete autonomy and could at any time have given up participating in the project. However, they did not.

At the first moment of the research (T1) the questionnaire was applied directly to G1 and G2. There were questions that evaluated variables such as: schooling, gender, workload, problems related to the profession, physical conditions of the work / care environment, time of practice and frequency of compliance.

The booklet on the Ergonomic and Biosafety Standards and folders for dental care was given to the participants and banners were placed in the participating institutions of the project, with the purpose of ratifying the knowledge that these professionals acquired in the undergraduate study about the risks to which they are submitted. ergonomic and biosafety standards. They were encouraged to look for improvements to the work environment so that they could offer greater productivity, providing a better quality care to the patients in the FHS and in the CSD.

Six months after the application of the questionnaire, without prior notice, the same participants were interviewed to evaluate whether there was a change in the posture of the groups regarding biosafety and ergonomics, after the information that was passed through folders and banners, applying second time the questionnaire (T2).

The groups were compared separately in T1 and T2 and in each other, G1 X G2 in both T1 and T2, according to the scores adopted in table 1 for the number of correct answers. Scores were applied for the number of correct answers for both ergonomics (E) and bi-osecurity (B) questions.

Nº of hits E	Score	Nºofhits B	Score
12	4	15	4
9 ≤ X ≤ 11	3	12 ≤ X ≤ 14	3
7 ≤ X ≤ 8	2	9 ≤ X ≤ 11	2
5 ≤ X ≤ 6	1	5 ≤ X ≤ 8	1
≤ 4	0	≤ 4	0

**Table 1:** Criteria for assessing issues of ergonomics (E) and biosafety (B)

Direct source. Parnaíba-PI. 2016.

The data were tabulated and analyzed by the statistical program SPSS, in its version 21. The Chi-square association test was performed to verify if there were significant differences in the results found. Descriptive statistics (measures of central tendency and dispersion) and construction of graphs were used in order to illustrate the findings of this research.

**Results**

In the G1, a sample of 24 professionals, aged between 23 and 40 years (mean = 29.8; dp = 4.31) and most (58.3%) of the female working 30.5 hours on average (SD = 12.20) per week. In G2 the number of academics was 33, with a mean age of 21 to 33 years (mean = 23.12; SD = 2.72), most of them female (57.6%), of 18.18 hours on average (SD = 2.45) on week.

Regarding the working day, in G1 it was verified that 11 (45.8%) paused for workout gymnastics/stretches. The others do not and point to neglect as justification. Of the total, 19 (79.1%) reported having pains in the spine (lumbar and cervical), wrists and shoulders. Twelve (50%) correlated the poor posture and 4 (16.6%) the physical work structure, with the pain they had, but 14 (58.3%) considered the ambient temperature and working conditions adequate.

All the academics stated that they did not pause during the work day at the school clinic, and 23 (69.7%) indicated having pain in the spine and shoulders. Eighteen (54.5%), related these pains to poor posture in care as the main causal factor. In 12 of them (36.3%), there was a higher prevalence of pain in the region of the cervical and lumbar spine. Six (18.2%) reported no pain. Twenty-eight (84.8%) considered the appropriate ambient temperature.

Table 2 showed a significant difference between G1 and G2 regarding ergonomics issues, both in T1 and T2. Graphs 1 and 2 show G1 and G2 responses to the work environment and ergonomics and biosafety (T1 x T2) standards. Biosafety issues were emphasized in Charts 3 and 4 (T1 x T2).

	p (E)/X <sup>2</sup>	p (B)/X <sup>2</sup>	gl (E)/gl(B)
G1 (T1 X T2)	0.92 n.s/0.51	0.89 n.s/0.62	3/3
G2 (T1 X T2)	0.99 n.s/0.19	0.91 n.s/0.18	3/3
G1 X G2 (T1)	< 0.01/14.24	0.14 n.s/5.48	4/3
G1 X G2 (T2)	< 0.01/15.43	0.15 n.s/5.12	4/3

**Table 2:** P value, X<sup>2</sup> e gl for the groups on the questions of ergonomics (E) and biosafety (B).

X<sup>2</sup>: Chi-Square Test; gl: Degrees of Freedom; n.s: Not Significant

Regarding the question on biosafety: “use of PVC film as a barrier in dental equipment”, the following responses were obtained: Group 1 (79.1%) and Group 2 (91%) considered it necessary to cover radiographic films with PVC of the radiographic intake to avoid contamination, but only 14 SDs (58.3%) and 32 academics (97%) use it. In addition, 54.1% of the SDs and 36.3% of the academics stated that they did not touch objects during the service, and the others that they touch, they do it using on gloves.

**Discussion**

Although G2 has a workload less than G1, it is assumed that the body pain that most present is due to the absence of pauses between the clinical appointments during the practical classes.

Inadequate movements, such as vibrations, repetitions, dynamic and static loads, lack of resting interval, associated with incorrect posture, and environmental aspects (lighting, noise, temperature, etc.) may be directly related to musculoskeletal disorders. The regions most affected by these disorders are mostly the neck, shoulder and lumbar spine [13].

When it comes to dental students these regions of the body are more susceptible to injury as they tend to acquire vicious habits in order to gain better vision and access to the field of work by raising the head, flexing the neck and rotating the shoulder and inappropriate position, thus promoting an unstable body position [14].

Regarding work position, Group 1 was unanimous in claiming to use more “11 hours” and is aware of the existence of Repetitive Strain Injuries (RSI) and Work-Related Musculoskeletal Disorders (DORT).

Regarding this issue, 39.4% of Group 2 reported working in the “11 o’clock” position and 27.2% in the “9 o’clock” position, which are the most recommended [7]. And only 57.6% are aware of injuries caused by work, LER or DORT.

Dental professionals and academics are advised to work at the 9 o'clock or 11 o'clock position in order to prevent occupational diseases. They should be well positioned and accommodated in the adjustable oval, keeping the forearm line parallel with the ground plane. The arms should be close to the body and the thighs parallel to the ground plane with the feet supported, as the slope of the spine will occur forward rather than sideways, which is more natural and normal in relation to the vertebrae [5,7].

Both groups indicated important alternatives for the prevention of DORT, namely: manual exercises with rubber balls, pleasant work environment, pauses, workers' awareness about LER/DORT, stretching and relaxation exercises, as well as adequacy of equipment according to Ergonomic analysis.

Both G1 and G2 have stated that surfaces that may be in contact with the patient or someone on the team. Such as light cords, X-ray cones, chair controls, head restraints, and others, should be protected with clear plastic, or with plastic wraps worn by the patient, being careful not to contaminate the adjacent surface during removal, corroborating with the findings of other authors [15-18].

The Ministry of Health recommended the following technical reminders on the use of gloves in dental practice: while wearing gloves, do not handle objects outside the work area (pens, patient files, door handles, etc.); remove the gloves immediately after the end of the treatment of the patient; do not touch the outside of the gloves when removing them; Wash hands as soon as gloves have been removed; gloves do not protect from needle punctures, but it is proven that they can reduce blood penetration by up to 50% of its volume and use of two pairs of gloves is formally indicated in long-term surgical procedures or with profuse bleeding, providing additional protection against contamination [6].

Regarding the disposal of sharp and sharp materials, both groups stated that it was made in leakproof resistant reservoirs. In accordance with standard precautionary measures, careful handling of puncturing objects is recommended by actions such as: avoiding re-picking needles or disconnecting them from syringes prior to disposal, and discarding piercing-sharps materials into suitable containers [17-21].

All surfaces on which the dental team touched the previous care, or that were contaminated with aerosols should be disinfected. It is recommended to use 70% alcohol (or 77GL), synthetic iodine compounds, phenolic compounds or sodium hypochlorite (0.5%) according to the surface material. Sterilization by water vapor has been the standard method of elimination of microorganisms in dentistry. To be sterilized in an autoclave, the cleaned material must be packed in packs, which must be made of material that allows steam to pass through, being the most recommended, shackle or kraft paper [17,18].

In dental practice it is common the contact of professionals with infected patients, who carry life-threatening diseases such as hepatitis B and AIDS. Both the patient is able to transmit diseases to the SDs and his team as vice versa. To prevent this from occurring, the professional must follow a list of biosafety standards such as: patient assessment and protection, personal protection, sterilization and chemical disinfection, equipment asepsis, disposal of garbage in a suitable place, disinfection of materials sent to the laboratory as was observed by several authors [11,19-21]. All these guidelines

were given to the CDs and academics who were involved in the research.

Six months after the application of the first questionnaire, the participants were again interviewed to evaluate if there was any change in the posture of the groups regarding biosafety and ergonomics, applying for the second time the questionnaire (T2).

The significant difference between G1 and G2 in both T1 and T2, as to the ergonomics issues, suggests that G1 not only has greater knowledge about norms but also experiences them, valuing work activity more than G2, trying not to contract occupational diseases due to ergonomic negligence (Table 2),

**Figure 1:** Relationship of the working environment with ergonomic and biosafety standards. Parnaíba and Luis Correia-PI. 2016.

**Figure 2:** Ergonomic and biosafety norms associated with the physical structure of the dental environment. Parnaíba and Luis Correia-PI. 2016.

There was no significant difference between the groups regarding biosafety issues in both T1 and T2, nor even between T1 x T2 for each group. Probably because both the SDs as the academics have acquired knowledge and used the PPE routinely, aiming at preventing work accidents, contracting occupational diseases or favoring cross infections among patients, keeping the chain aseptic, although some sometimes neglect with respect to the biosafety standards (Table 2) (Figures 3 and 4).

**Figure 3:** Precautionary measures in the workplace. Parnaíba and Luis Correia-PI. 2016.

**Figure 4:** Sterilization of materials and disinfection of dental equipments. Parnaíba and Luis Correia-PI. 2016.

Regarding the lack of dental materials, in T1, 14 SDs (58.3%) reported being frequent and in T2 there was an increase in complaints from 16 professionals (66.6%). There was an improvement from 13 (39.4%) in T1 to 15 (45.4%) in T2, regarding the students' complaints regarding materials (Figure 2).

Regarding the sterilization of low and high rotation pens, there was a change of perception in both groups from T1 to T2. In T1, only 14 SDs (58.3%) stated that high and low rotation pens should be sterilized. In T2, 91.6% confirmed that it was more appropriate to sterilize them. As for academics, this change in perception was more expressive, from 28 (84.8%) in T1 to 33 (100%) in T2 (Figure 4).

It is suggested that courses on Ergonomics and Biosafety be offered in Permanent Education for the SDs that work in the FHS.

### Conclusion

- There were statistically significant differences between G1 and G2 regarding knowledge of ergonomics norms;
  - Ergonomic and biosafety standards are possible to perform in both groups;
  - Everyone was made aware of the consequences of noncompliance;
  - Both G1 and G2 know the risks they are exposed to, but some disagree with ergonomic and biosafety standards.
- The FHS and the School Clinic of the University coordinators were provided with data that can assist in the planning and re-evaluation of the services provided by the SD and academic staff, as well as the physical structure of the institutions involved, pointing out improvements in biosafety and ergonomics.
  - The interpretation of the results should consider some limitations inherent in this study. It is important that future studies be carried out on the evaluation of ergonomics and biosafety standards in FHS and dentistry undergraduate courses.

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