Review

RESP

Oral Care in the Spanish Prison Setting

Ana Isabel Martínez-Díaz-Canel, Elena Martín-Fernández, Marta García-González

University Clinic of Dental Science. University of Oviedo.

ABSTRACT

Introduction: Addressing the health problems of prison inmates is a major challenge for public administrations, which are responsible for guaranteeing the necessary services to deal with them. It is therefore essential to know which are the chronic pathologies that affect them most frequently, what impact they have on the oral cavity and what type of treatments are required. The aim of this study is to shed further light on these questions.
Material and method: Articles in PubMed on chronic and oral pathologies and treatment needs were reviewed.
Results: The most prevalent chronic pathologies are heart disease, chronic respiratory disease, diabetes and cancer. Anxiety and depression are also highly prevalent among the prison population, along with the consumption of tobacco, alcohol and drugs of abuse. They are responsible for the appearance of caries and periodontal diseases, the treatment of which should be carried out in the prison environment.
Conclusions: The level of dental care among the prison population is very low. Therefore, it is necessary to implement preventive and therapeutic measures among inmates to improve their oral health and, consequently, their general health.

Key words: chronic diseases; risk factors; prisons; oral pathology; treatment needs.

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INTRODUCTION

Addressing the health problems of prison inmates is a major challenge for public administrations, which are responsible for ensuring that necessary provisions are made to deal with them.

The prison population presents a set of unique social and medical characteristics that should be taken into account when considering healthcare options:

- Social background: The individuals concerned often come from extremely marginalised or even excluded settings. They may therefore present pathologies that are often associated with or aggravated by poverty, the outcome of difficulties in accessing healthcare and self-care resources that are common in such cases.
- As a result of the above many inmates present with a major deterioration of their general state of health, which needs to be deal with in the prison setting.
- There is also a high incidence of pathologies associated with drug dependence, which is quite common in the prison population (HIV, AIDS, hepatitis y and mental illness).

All these factors may be linked or lead to a deterioration in oral health, which should be treated in the prison setting.

The aim of this study is to describe the chronic pathologies of prison inmates, including their risk factors and epidemiological considerations. We also set out to assess the oral symptoms of these pathologies and the consequences for the oral health of this population. We conclude by considering the possible needs for oral treatment that should be provided for and guaranteed in prisons.

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GENERAL PATHOLOGY IN THE PRISON POPULATION

The world's prison population has greatly increased in recent years and there has been a parallel increase in the age of inmates. This latter point is important in clinical terms since there are likely to be a larger number of chronic pathologies

The four main non-communicable chronic diseased identified by the World Health Organisation (WHO) are cardiovascular diseases, diabetes, cancer and chronic respiratoria pathology[1], which are also related to high mortality levels. Although such diseases affect individuals of all social levels, there is a higher incidence of them in more disadvantaged strata, where many inmates often come from.

A study by Vera Remartínez *et al*. on a total of 1,077 subjects interviewed in nine Spanish prisons established a prevalence of dyslipidaemia of 34.8%, high blood pressure of 17.8%, diabetes of 5.3%, asthma of 4,6%, COPD of 2.2%, coronary heart disease of 1.8% and cardiovascular diseases of 1.5%. The most notable risk factors included smoking amongst 70.4% of the inmates and cocaine consumption amongst 30.5%; while overweight, obesity and sedentarism was found in 39.6% (12.3% and 38.5% respectively)[2].

Wright *et al*. carried out a study in the UK on a total of 199 participants in 2019. The most common diseases were anxiety and depression (34%), followed by respiratory pathology (17%) and high blood pressure (10%); heart disease, stroke, cancer and diabetes presented a similar prevalence, at 2% each. 27% of the subjects had a record of drug abuse and 16% of alcoholism, while 83% of the participants smoked. 19% did no physical exercise during their stay in prison[3]. A systematic review and meta-analysis by Manna S *et al.* in India showed that the prevalence of depression amongst inmates stood at 48.78%, making it the most common mental illness in the prison population, which matches the data for prevalence provided by another meta-analysis conducted in Ethiopia, where 44.45% of the population suffered from this disease[4].

Infectious pathologies are also a major issue in the prison setting. A study carried out in Mexico by Arredondo *et al.* on the epidemiology of communicable diseases amongst a sample of 17,000 inmates showed the following figures for prevalence: HIV 0.7%; syphilis (Anti-TP+/VDRL+) 2%; Hepatitis B (HBcAc 2.8%, HBsAg 0.15%); Anti-HCV 3.2%[5].

TBC is often highly prevalent in prisons, especially in developing countries. A meta-analysis by Ferreira on the epidemiology of this infectious disease showed figures for prevalence of active TBC of 3,13% in countries with a low-medium economic level, while this figure dropped to 2.25% in more developed countries[6].

ORAL SYMPTOMS OF GENERAL PATHOLOGIES

The oral repercussions of these highly prevalent diseases are many and varied; either as a direct result of the disease itself or because of the treatments used. These repercussions are summarised in Table 1.

Cardiovascular disease

Alongside the dental treatments required due to situations of antiplatelets/anticoagulation, decompensations, need for drug treatment due to the presence of cardiac valve prostheses, drug interaction, anaesthetic contraindications, etc., which are very common amongst such patients, we may also see:

- Drugs used to treat heart disease, heart failure and high blood pressure, such as diuretics, may lead to a reduced flow of saliva, which implies a greater risk of caries and oral infections (mainly candidiasis).
- Anti-arrhythmic drugs such as nifedipine and verapamil are responsible for the appearance of gingival hyperplasia that is difficult to treat.
- On the other hand, according to the European Society of Cardiology, periodontitis is associated with endothelial dysfunction, atherosclerosis and an increased risk of myocardial infarction and stroke[7].

Respiratory pathology

The drug treatments commonly prescribed for such patients may have different effects on oral structures. These include:

- Beta-adrenergic antagonists produce hyposalivation, with a decrease in salivary proteins and an increase in *Streptococcus mutans* in the saliva. This increases the risk of caries.
- Inhaled corticoids increase the risk of candidiasis and mouth ulcers.

Diabetes

The impact of this disease on the oral cavity can appear in the following ways:

- Periodontitis, which is closely related to the level of metabolic control of diabetes.

Table 1. Summary of effects of systemic pathologies on oral cavity.

Pathology	Etiopathogenesis	Oral effect
Cardiovascular disease	Drugs that reduce flow of saliva	Increased risk of caries Increased risk of oral infections
	Anti arrythmia drugs	Gingival hyperplasia
Respiratory pathologies	β-adrenergic agonist: reduce Flow of saliva Inhaled corticoids	Increased risk of caries Increased risk of infections Increased risk of candidiasis
Diabetes		Periodontitis Increased risk of caries Increased risk of infections (candidiasis)
Liver diseases	Nutritional defects	Glossitis, cheillitis Lingual depapilation
	Changes to coagulation	Haemorrhages
HIV	Parotid infiltration: hyposalivation	Increased risk of infections Candidiasis, queilitis Hairy leukoplakia Periodontitis Kaposi's syndrome (palate) Increased risk of caries Increased infections
Psychiatric disorder	Increased sugar consumption Increased smoking Poor oral hygiene Drugs that produce hyposalivation	Increased risk of caries Increased risk of periodontitis

Note. HIV: human immunodeficiency virus.

- Hyposalivation secondary to polyuria and bilateral parotid hyperplasia.
- As a result of the above, there is a higher prevalence of caries and oral infections, dry socket, candidiasis, angular cheilitis, median rhomboid glossitis, etc.
- Delayed wound healing.
- Links to oral lichen planus and the appearance of lichenoid lesions.

Liver diseases

The following may be observed in infectious pathologies and diseases related to chronic alcohol consumption that have led to cirrhosis:

- Lesions associated with nutritional defects secondary to alcohol consumption such as glossitis, cheilitis, lingual depapilation caused by lack of folates.
- Perioral scabs due to lack of zinc.
- Gingivitis and haemorrhages.

HIV

Many disease patterns are associated with this immunodeficiency, but the most common one is oral candidiasis oral in its atrophic or erythematous forms.

Other oral manifestations are:

- Angular cheilitis, in patients with teeth.
- Hairy leukoplakia: characterised by the presence of small white, folded or filiform formations on the lateral edges of the tongue that look like hairs.
- Periodontal diseases, such as severe periodontitis, with fast, generalised and irregular destruction of the periodontal support; gingivitis, necrotising periodontitis and linear gingival erythema can also be observed in such patients.
- Kaposi's sarcoma, the lesions of which are commonly found on the palate.
- Non-Hodgkin's lymphoma.
- Increased size of parotid due to lymphocyte infiltration, which leads to reduced saliva secretion.
- Infections from herpes simplex virus, varicella zoster (with impact on the 2nd and 3rd branches of the 5th cranial nerve) and human papilloma virus (responsible for appearance of warts, papilloma, condylomata acuminata and epithelial multifocal hyperplasia).
- Bacterial infections.

Advances in the treatment of this disease has brought about changes in how it presents orally. The current oral profile is characterised by erythematous

Rev Esp Sanid Penit. 2024;26(3):113-120
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candidiasis on the tongue and palate (occasionally pseudomembranous), with hairy leukoplakia, without herpetic lesions or Kaposi's sarcoma. It should be remembered that oral lesions may present in immune reconstitution syndrome[8].

Psychiatric disorders

These patients suffer from a high risk of caries and periodontal diseases due to a high consumption of refined carbohydrates, high levels of smoking, deficient oral hygiene and drug treatments that can often produce a reduction in salivary secretion.

Anti-psychotic medication may also be responsible for the appearance of dyskinesias and dystonia, which cause involuntary movements of the tongue and the facial musculature[9].

Drug abuse

The direct impact of these substances on oral health includes hyposalivation/xerostomia, due to frequent consumption of sugary foods (possibly because of activation of μ opioid receptors, causing changes in glucose consumption and glycaemic controls) and the association with bruxism described amongst such patients.

Their lifestyle and the lack of importance they tend to give to their health in general, and to their oral health in particular, along with poor oral hygiene, have an indirect influence on the appearance of oral diseases.

Tobacco and alcohol

The prison population presents very high consumption levels of these substances, especially tobacco. These are important risk factors in all the pathologies described above. They exponentially increase the risk of cancer by themselves and even more so when they are associated.

ORAL DISEASES

As explained above, many of the systemic pathologies described above will have an effect on the pathogenesis of the most prevalent oral diseases: caries and periodontal disease. Table 2 shows the values for the prevalence of caries and the DMFT index recorded in the reviewed publications.

Some studies have highlighted a higher prevalence of both pathologies amongst inmates when compared to the general public. In a study published in 1985, M.A. Cunninghan *et al.* compared the prevalence of oral disease in a prison population (99 males, from 18-30 years of age) compared to a group of 101 males of the same age group who were not inmates: they found statistically significant differences between both groups in each of the DMFT components (Index of cavities, D-lost due to cavities, M-filled, F), with figures for cavities (3.0) and losses from cavities (1.7) that were much higher in the first group than in the non-inmate sample (0.8 and 0.6 respectively); on the other hand, the figures for filled teeth were much higher in the second group (9.0 compared to 5.6)[10].

M. E Salive *et al.* carried out a study on prevalence at a prison in the USA in 1989 on a sample of 178 males. They found a mean of the DMFT index of 10.5 in the 18-29 age group, 17.1 in the 30-44 group and 22.4 amongst inmates over 44 years of age. These figures are very high, and are even higher when they are compared to those of the general public, who have fewer teeth lost due to caries and fewer uncovered treatment needs[11]. Another American study published in 2002 by Heng and Morse showed a DMFT index of 16.8 when analysing a group of 500 female inmates at a prison in Connecticut[12].

Reddy *et al.* carried out a study that analysed the state of oral health and treatment needs amongst the population of seven prisons in India, in a sample of 800 inmates (722 men and 78 women). The prevalence of caries was 92.5% with a DMFT index of 5.26; deficient oral hygiene was observed in 66.3% of the subjects, 39.3% had a CPI (community periodontal index) of 2 (presence of calculus) and 48.6% had a CPI of 3 or 4 (bags of 4-5 mm. or more)[13].

Balkrishna *et al.* published figures about caries after examining a total of 573 inmates (534 men and 39 women). They determined a prevalence of 77%; in this case the DMFT index was similar to the previous one, 5.40 ± 6.49, although they observed a significantly high mean score ($p = 0.002$) amongst women (5.77 ± 6.188). Furthermore, they found a significant difference when the mean score of this index was compared to the period of imprisonment, where the highest mean score was 6.97 ± 7.69 for 5-10 years[14].

A similar trend was observed by Kumar in a study on a sample of 532 inmates, who were grouped according to the length of stay in prison (less than 3 years, 3 to 6 years, 6-10 years). In this case, the mean DMFT was 7.18 ± 3.93, and this index was seen to increase from a value of 6.34 ± 4.04 in the first group to 8.03 ± 3.78 in the third[15].

On the other hand, Clare observed that there was a major reduction in dental caries (46.3%) amongst individuals who spent more than three years in prison,

Table 2. Observed values of caries prevalence and DMFT index.

Author	Sample	Prevalence	DMFT	Observations
Cunninghan	99 men/101 control			D:3.0/0.8; M:1.7/0.6; F:5.6/9
Salive	178 men		10.5 in 18-29 years 17.1 in 30-44 years 22.4 in >44 years	
Heng	500 women		16.8	
Reddy	722 men+78 women	92.5%	5.26	
Balkrishna	534 men+39 women	77%	5.40 ± 6.49	5.77 ± 6.188 in women (p = 0.002)
Kumar	532		7,18 ± 3,93	Increased with treatment in prison
Clare				Decreases after 3 years
Cavalcanti	127 men		19,72 ± 6,29	DMFT increases with age
Bukhari	82 men/79 control			Comp. F: 1.46 ± 2.45 Comps. D and M much Amongst inmates
Soares	103 men		17.17 ± 8.23	Comp F: 1.86 ± 2.48

Note. Comp.: component; DMFT: decayed, missing and filled teeth index, number of teeth that are carious (D), plus the ones lost from caries (M) and filled teeth (F).

with a decrease in the component "D: carious" from 6.7 to 3.6. He considered that this was due to filling carious teeth, the extraction of teeth that could not be recovered and availability and access to dental services in prison[16].

Cavalcanti, *et al.* published a study in Brazil after analysing 127 male prisoners. They recorded a DMFT index of 19.72 ± 6.9, the value of which increased in line with age. The component "D: carious" was the largest one of the index, while component "F: filling" had a mean value of 1.46 ± 2.45, which shows the lack of importance in conservative treatment strategies[17].

Bukhari *et al.* compared the DMFT index and its components between a group of 82 male inmates at two prisons in Saudi Arabia and a control group made up of 79 individuals of a similar age, gender and educational level. They saw that the percentages of carious teeth (component D) (90.2%) or lost due to caries (component M) (80.5%) were much higher in the study group than in the control subjects (D: 57%, M: 60.8%). On the other hand, the percentage of filled teeth (component F) was considerably lower in the group of inmates (31.7% compared to 50.60%)[18].

Soares *et al.* carried out a study in Portugal on a sample of 103 male inmates with an average age of 41.58 ± 8.94 years. They found a DMFT index of 17.17 ± 8.23, basically caused by lost teeth, while the average for filled teeth was 1.86 ± 2.48, which likewise highlights the reduced level of treatment received. No significant relationship was found between caries lesions and drug abuse. Of the 96 patients who had teeth, 41.7% suffered from periodontitis, 32.3% from gingivitis, while only 26% were periodontally healthy. In this case there was a statistically significant relationship with tobacco consumption[19].

Akaji and Ashiwaju carried out a study to determine the oral health of 230 inmates (224 men and 6 women) in a prison in Nigeria. One notable finding was that only 5.2% of the participants had a CPI = 0, while 94.8% had some kind of periodontal issue; to a lesser degree amongst those who practiced some form of correct oral hygiene[20]. Along the same lines, Vainionpää *et al.* in a study on 100 subjects at a prison in Finland found that 93% had a CPI of 2 or more[21].

It can be seen then that periodontal disease constitutes a global problem amongst inmates, especially those with a record of drug abuse, who present higher figures for periodontitis[22].

As regards diseases of the oral mucosa, Reddy *et al.* found in their study that 20.5% of inmates presented lesions of the oral mucosa: oral submucosa fibrosis (9.9%), ulcers (9.9%) and leukoplakia (1.1%)[13]. Kondratyev, in a study of 305 inmates (175 men and 130 women) observed a prevalence of bitten mucosa of 53.1%, stomatitis nicotina of the palate (28.8%), leukoplakia (82%), hyperplastic lesions (6.8%), while lingual pathologies and candidiasis were present in 21.9% and 4.9% of the cases respectively. It

Rev Esp Sanid Penit. 2024;26(3):113-120
10.18176/resp.00096

should also be noted that a sizeable number of these pathologies had smoking as the main aetiological factor[23].

Rawlani *et al.*, carried out a study in India on the prevalence of premalignant lesions of the oral mucosa. They found mean figures of 34.28%, with 25.43% of the inmates diagnosed with oral submucosa fibrosis, and 7.422% with leukoplakia. They felt, as did other authors, that such high levels of oral lesions could be attributed to smoking, although in this case betel nut was also a common factor in this country[24].

TREATMENT NEEDS

There are many challenges when providing dental services in the prison setting. These may be due to a number of causes: the negative attitude of many inmates to dental care and health, the lack of available dental care resources in prisons and the difficulties involved in gaining access to external dental services.

The information about risk factors for the most prevalent chronic disease mentioned by Vera Remartínez[2] and its relationship to different oral diseases, means that it is essential to invest resources: firstly, in health education for prisons; inmates need to know that controlling such risk factors will not only benefit their overall health, but also their oral health. Secondly, it is necessary to implement preventive, corrective and suppressive measures for such factors. These include:

- Promoting measures to give up smoking and drug abuse.
- Drawing up nutritional protocols and programmes that can easily be utilised in prison, to permit the control and reduction of overweight and obesity.
- Facilitating physical exercise in prisons.

Furthermore, given the awareness of the repercussions of this general pathology on oral health, early diagnosis programmes for these potential consequences should be established (secondary prevention), with regular checkups of the oral cavity and all its structures. Another equally important tool at this stage would be preventive measures (primary prevention) to stop such pathologies from appearing. The following measures are especially important:

- Promotion of measures to control oral bacterial plaque, teaching inmates adequate teeth brushing techniques and the correct use of accessories that help to improve oral hygiene (dental floss, interdental brushes, water jets, etc.).
- Use of toothpaste with a suitable fluoride content (minimum pf 1,450 ppm) three times a day.
- Use of chemotherapeutic agents (clorhexidine, triclosan, etc.) that contribute to controlling periodontal diseases.
- Dietary advice and diet control programmes, to enable inmates to reduce the quantity and frequency of refined sugars consumed, which are key factors in the etiopathogenesis of dental caries.
- Use of professionally applied fluoride (gels and varnishes) where necessary.

As the studies mentioned above indicate, one important factor in treatment needs is that the value of component "F: filled" of the DMFT index is much lower amongst inmates than it is in the general public, which indicates a poor degree of dental care; as is the case with periodontal disease.

Reddy found that 57.1% of inmates had lost one or more teeth due to the lack of dental services. With a prevalence of caries of 92.5% and a DMFT of 5.26, 97.4% of the subjects required correct instructions for oral hygiene, 87.6% needed fillings, 59.2% required pulp treatment, 62.1% needed to have a tooth extracted and 32.2% the repositioning of a tooth lost via a prosthesis[13].

Korkosz *et al.* carried out a retrospective study on the needs for dental treatment of a group of 86 inmates compared to a control group made up of 106 men who lived outside prison. They found that the need for endodontic treatment was significantly higher in the study group and that endodontic therapy was significantly less frequent (19 subjects compared to 54) amongst inmates. There were no statistically significant differences between both groups in the quality of treatment, or in the presence of periapical changes or symptoms associated with treatment failure[25].

As mentioned above, Vainionpää *et al.* examined a sample made up of 100 inmates (89 men and 11 women) and determined a CPI of 2 or more in 93% of the individuals, in which 67.7% of those under 30 years of age presented calculus and therefore required scaling, while 29.4% (with a CPI of 3 or 4) required periodontal treatment. In cases over 30 years of age, 49.9% had calculus that needed to be removed with scaling, while 34.4% needed periodontal treatment[21].

Kumar assessed the need for prosthetic treatment in a sample of 532 inmates. 11.3% required a single crown in the upper or maxillary arch, 6.2% needed several crowns or a fixed prosthesis of several units, 1.3% needed a mixed prosthesis and 0.6% a complete one. In the lower or mandibular arch, 12.2% needed a single crown, 7.5% several crowns or a fixed prosthesis, 2.3% a combined crown and fixed prosthesis and 0.8% a complete lower prosthesis[15].

CONCLUSIONS

The important consequences of chronic disease on oral health and the high prevalence of related oral diseases make it necessary to establish a series of interventions to improve dental care for inmates.

- Preventive activities designed for the prison population are essential, as are early diagnosis programmes for oral diseases.
- These preventive activities should include health education, which is vital for ensuring that inmates become aware of it and the role that they can play in improving their health by acquiring healthy habits.
- Early diagnosis programmes are especially important for minimising dental deterioration and subsequent treatment needs.
- It is necessary to establish controls over these preventive and diagnostic activities, to enable information to be gathered about the real treatment needs of the prison population. By doing so, the authorities responsible for this area will have information that can be used as the starting point for strategies to improve oral health in the prison setting.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with respect to the research, authorship, and/or publication of this article.

CORRESPONDENCE

Ana Isabel Martínez-Díaz-Canel
E-mail: martinezana@uniovi.es

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