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ANALYSIS OF THE INTERDEPENDENCE BETWEEN CLINICAL AND PSYCHOSOCIAL FACTORS IN PAIN MANAGEMENT IN DENTISTRY: A MICMAC PERSPECTIVE.

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Abstract:
The aim of this study was to analyze the interdependence between clinical and psychosocial factors in pain management in dentistry, using the MICMAC methodology. An observational and descriptive study was carried out, in which primary and secondary data were collected. Data was collected through structured questionnaires and a review of medical records. Clinical factors such as the type of dental procedure, the intensity and duration of pain, the anesthetic techniques used, and the use of analgesic medication were analyzed. Psychosocial factors such as dental anxiety and fear, social support, coping strategies, and the patient's previous experiences were also examined. The results showed a significant interdependence between the clinical and psychosocial factors analyzed. Key factors that had a significant impact on the perception and management of dental pain were identified. The findings suggest that by considering these interrelated factors, dental professionals can develop more effective and personalized strategies to alleviate dental pain. However, limitations such as the subjective nature of the technique are recognized, which requires caution in interpreting the results

Keywords: Dental pain, pain management, MICMAC, interdependence, quality of life.

Introduction

Dental pain is a commonly lived experience by patients seeking dental care (Paisi, et al., 2020). Adequate pain control is essential to guarantee the comfort and well-being of the patient and improve the quality of dental care (Chávez, Kossioni, & Fukai, 2022). However, dental pain is not simply a physical response but is also influenced by a variety of clinical and psychosocial factors. Over the years, numerous studies have examined the relationship between clinical and psychosocial factors in

pain management in dentistry. It has been shown that the type of dental procedure, the duration of the pain, the intensity of the pain, the anesthetic techniques used, and the use of analgesic medication, among others, can play a crucial role in the experience and perception of pain.

For example, previous research has suggested that the type of dental procedure may influence the amount of pain experienced. Some studies have found that more invasive or complex procedures, such as wisdom tooth extraction or root canal treatments, are associated with a higher level of postoperative pain (Bedeloglu, 2022; Takadoum, et al., 2022). These findings highlight the importance of considering the type of dental procedure when addressing pain management in dental practice. In addition, the duration and intensity of pain are key factors that can affect the quality of life and general well-being of patients. Previous studies have revealed that perceived pain intensity can vary widely between individuals and that those with higher pain intensity may experience greater interference with their daily activities and decreased quality of life (Tagliaferri, et al, 2020).

Taking into account the importance of these clinical and psychosocial factors in the management of dental pain, it is crucial to carry out a deeper analysis of their interdependence and their influence on the quality of life of patients. In this study, a comprehensive analysis of the interdependence between clinical and psychosocial factors in pain management in dentistry is performed. Implementing the MICMAC methodology, the influence and interconnection of these factors in relation to dental pain management are examined and revealed. Understanding the interdependence between these clinical and psychosocial factors is critical to developing comprehensive and personalized approaches to pain management in dentistry (Wang, et al., 2017; Rakshdan, 2015).

Therefore, the objective of this article was to examine each factor in detail, analyzing its importance and its interaction with other factors, and to provide a comprehensive perspective on pain management in dentistry from the MICMAC methodology. In addition to filling a gap in the existing literature, this study may also contribute to improving dental practice by providing key information on how to effectively address pain management in the context of dental care. By understanding the interdependence and influence of these factors, dental professionals will be able to develop more individualized and personalized approaches to pain management, thereby improving quality of life and patient experience.

In the following sections, the methodology and results of this analysis will be presented, highlighting the interdependence and influence of each factor in the management of dental pain. In addition, the clinical implications will be discussed and recommendations will be provided to improve dental practice and optimize the patient experience. In summary, this study provides a holistic and detailed view of clinical and psychosocial factors in pain management in dentistry. By understanding the interdependence between these factors, more effective pain management strategies can be developed, improving patients' quality of life and providing high-quality, comprehensive dental care.

Methodology

This study was classified as observational and descriptive (Sampieri, 2018), and primary and secondary data were collected to analyze the interdependence between clinical and psychosocial factors in pain management in dentistry. Experts were selected who helped identify the relevant factors that were considered relevant to the analysis of the interdependence between clinical and psychosocial factors in pain management. Structured questionnaires were used to collect data on relevant clinical and psychosocial factors. These expert-directed questionnaires included questions about the type of dental procedure, duration and intensity of pain, anesthetic techniques used, use of analgesic medication, dental anxiety and fear, social support, coping strategies, and previous experiences of the patient. Secondary data will also be collected through a review of medical records and records of previous dental treatment.

The MICMAC (Multiplicative Cross Impact Matrix Applied to a Classification) methodology was used to analyze the interdependence between clinical and psychosocial factors in pain management in dentistry. An interdependence matrix was built to show the relationships and influence between the different factors (Arango & Cuevas, 2014). A cross-impact analysis was carried out to determine the

influence of each factor on the others, identifying the most influential factors and their degree of influence. The results of the MICMAC analysis were interpreted and discussed concerning the objectives of the study. Relationships and interactions between clinical and psychosocial factors were examined, and key factors in pain management in dentistry were identified. The clinical implications of the findings were discussed and recommendations to improve pain management in dental practice were provided.

Results

The bibliographic analysis revealed a series of elements that influence pain management in dentistry, which have been classified into two main categories: clinical factors and psychosocial factors. Within the category of clinical factors, six subfactors have been identified: type of dental procedure, duration of pain, intensity of pain, anesthetic techniques used, use of analgesic medication, and postoperative complications. On the other hand, in the category of psychosocial factors, six subfactors have also been identified: anxiety and dental fear, expectations and beliefs, social support, coping strategies, previous experiences, and quality of life.

These factors or variables have been recorded in Table 1, which consists of four columns: the number of the factor, the code or abbreviated name of the factor, the full name of the factor, and its corresponding description. For example, the first row of the table represents factor number one (1), identified with the TDP code, which refers to the Type of dental procedure. The description associated with this factor is as follows: "Includes extractions, implants, orthodontics, among other procedures." In this way, the information presented in Table 1 can be interpreted and understood.

Table 1. Selected factors to apply MICMAC.

#	Code	Factor	Description
Clinical factors			
1	TDP	Type of dental procedure	Includes extractions, implants, orthodontics, among other procedures.
2	PI	Pain intensity	Evaluates the magnitude of the pain experienced by the patient, using evaluation scales such as the Visual Analogue Scale (VAS) or the Numerical Pain Scale (NPS).
3	PD	Pain duration	Determines the persistence of pain after the dental procedure and during the recovery period.
4	ATU	Anesthetic techniques used	Includes the type of local anesthesia administered and its effectiveness in pain control.
5	UAM	Use of analgesic medication	Evaluates prescription and patient adherence to prescribed analgesic medications.
6	PC	Postoperative complications	Refers to health problems or side effects that can occur after a dental procedure, such as infection, excessive bleeding, or persistent pain. These complications can influence the patient experience and pain management in dentistry.
Psychosocial factors			
7	ADF	Anxiety and dental fear	Evaluates the level of anxiety and fear experienced by the patient before and during the dental procedure.

8	EB	Expectations and beliefs	Investigates the patient's expectations and beliefs about dental pain and their ability to manage it.
9	SS	Social support	Considers the emotional and practical support the patient receives from their social environment, such as family, friends, or support groups.
10	CS	Coping strategies	Analyzes the strategies used by the patient to cope with dental pain, such as relaxation techniques, deep breathing or distraction.
11	PE	Previous experiences	Investigates whether the patient has had previous negative or traumatic experiences related to dentistry and how this may influence their perception of pain.
12	QL	Quality of life	Evaluates the impact of dental pain on the patient's quality of life, considering aspects such as sleep, eating and daily activities.

Source: Authors

The list shown in Table 1 facilitates the possibility of carrying out a comprehensive evaluation together with a team of experts in order to analyze the interactions of influence and dependence between each factor. This procedure was carried out through the use of a matrix that shows the direct connections of influence and dependency, which was completed with values obtained through the joint reflection of the experts. This process corresponds to Phase II of the MICMAC technique.
Figure 1 shows the Matrix of Direct Influence/Dependence, which was completed with values from 0 to 3 according to the criteria of the experts consulted for this study. As can be seen in the figure, the first row corresponds to the relationships of the factor: Type of dental procedure (TDP) with the rest of the factors. In the case of the relationship between the TDP factor and the Pain intensity (PI) factor, it is a strong relationship because it has a value of three (3), which suggests that there is a significant connection between these two factors. In the same way, its relationship with the Duration of pain (PD) factor is strong (3), and with the Anesthetic techniques used (ATU) factor it is moderate (2), as well as with the factors: Use of analgesic medication (UAM), Postoperative complications (PC) and Anxiety and dental fear (ADF), which implies that the Type of dental procedure factor has a moderate influence on the three factors mentioned. In this way, the information presented in Figure 1 can be interpreted and understood.

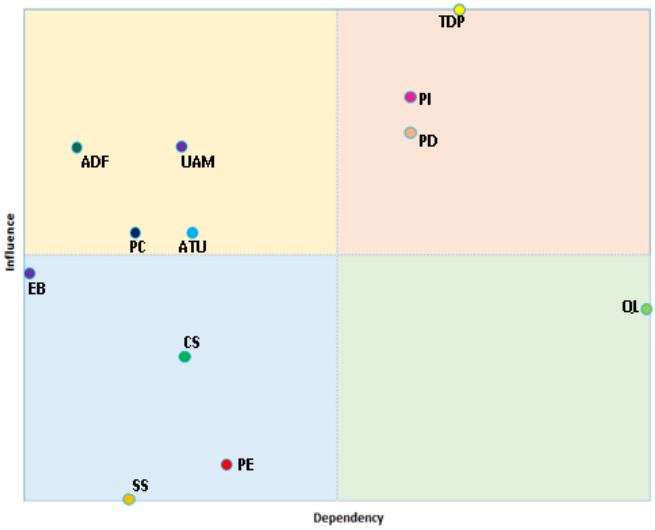
Figure 1. Matrix of Direct Influence/Dependence

	TDP	PI	PD	ATU	UAM	PC	ADF	EB	SS	CS	PE	QL
TDP	0	3	3	2	2	2	2	1	2	1	3	3
PI	3	0	3	1	1	3	2	2	1	2	0	3
PD	3	3	0	1	1	2	2	0	3	2	1	2
ATU	2	3	3	0	2	0	1	0	1	0	2	3
UAM	3	2	2	3	0	1	0	1	0	3	1	3
PC	0	3	3	2	1	0	1	2	2	1	0	2
ADF	3	1	0	1	2	2	0	2	1	2	2	3
EB	3	0	0	1	2	2	1	0	2	1	2	2
SS	0	2	2	0	0	0	0	0	0	1	1	3
CS	2	1	1	2	1	1	2	1	1	0	1	0
PE	2	0	0	1	1	0	1	3	0	1	0	1
QL	0	2	3	1	2	1	1	0	1	1	3	0

Source: Authors

After filling in the matrix of direct influence/dependence with the value of the relationships of each factor, their result was the location and classification of each factor. This classification can be observed in a four-quadrant plane where the key, determinant, autonomous, and result factors are located. This plane is presented in Figure 2. The structural analysis revealed the existence of three key factors located in the first quadrant (upper right corner), namely: Type of dental procedure (TDP), Pain intensity (PI), and Duration of pain (PD). In the second quadrant (upper left corner) four determinant factors were located, namely: Anxiety and dental fear (ADF), Use of analgesic medication (UAM), Postoperative complications (PC), and Anesthetic techniques used (ATU). The factors that were classified as autonomous were located in the third quadrant (lower left corner), namely: Expectations and beliefs (EB), Social support (SS), Coping strategies (CS), and Previous experiences (PE) and finally only one was classified as a results factor (bottom right corner): quality of life (QL).

Figure 2. Plan of direct influence / dependency



Source: Authors

Below are the results of the categorization of the factors through the use of the direct influence matrix, which are explained in detail in Table 2.

Table 2. Classification of variables by direct influences/dependencies

Type of factors	Factors	Code
Key, strategic or challenge factors	Type of dental procedure	TDP
	Pain intensity	PI
	Pain duration	PD
Determinant or "influencing" factors	Anesthetic techniques used	ATU
	Use of analgesic medication	UAM
	Postoperative complications	PC
	Anxiety and dental fear	ADF
Autonomous or excluded factors	Expectations and beliefs	EB
	Social support	SS
	Coping strategies	CS
	Previous experiences	PE
Dependent or outcome factors	Quality of life	QL

Source: Authors

The type of dental procedure (TDP) turned out to be a key factor, this is so due to its influence on pain intensity, duration, treatment, and medication options, as well as associated psychosocial factors. Understanding this factor is essential to provide optimal and personalized care to patients. In Dilmahomed & Jovani-Sancho (2019), it is noted that the type of dental procedure can vary in its degree of invasiveness and complexity and can influence the duration of pain experienced by the patient. Similarly, depending on the type of procedure, different treatment approaches and medication may be used to control pain.

On the other hand, pain intensity is key in pain management in dentistry because it provides crucial information for assessment, diagnosis, treatment planning, selection of pain management strategies, and evaluation of treatment efficacy. Understanding and properly addressing pain intensity is critical to providing comprehensive dental care and improving the patient experience. Gruen, et al. (2022) explain that the intensity of pain is an important indicator to evaluate and diagnose the dental problem, likewise, it also influences treatment planning. On the other hand, if the pain is mild or moderate, less invasive treatment options may be considered. Pain intensity helps guide the sequence and urgency of dental treatments.

The last factor that was key was Duration of pain, due to its influence on treatment planning, pain management strategies, the impact on the patient's quality of life, and the evaluation of treatment efficacy. Considering and addressing the duration of pain is critical to providing optimal dental care and improving the patient experience. In this regard, Idon, Sotunde, & Ogundare (2019), affirm that the duration of pain helps dental professionals to plan the appropriate treatment. Likewise, they state that the duration of pain influences the pain management strategies that will be used, in addition to having a significant impact on the quality of life of the patient. Prolonged pain can negatively affect the ability to eat, talk, sleep, and perform normal daily activities. Likewise, the duration of pain is an important indicator to evaluate the efficacy of dental treatment.

Regarding the determining factors, the anesthetic techniques used was one of these, due to their ability to provide pain relief during the procedure and control postoperative pain. The selection and proper application of anesthetic techniques have an impact on the patient experience, pain control, and safety during dental treatment. Babaie, Taghvimi, Hong, Hamishehkar, & Kim (2022) state that the choice and effectiveness of the anesthetic techniques used can make a big difference in the patient's experience and their ability to tolerate the dental procedure. In addition, it can help minimize the pain and discomfort that the patient experiences after dental treatment. The correct choice of anesthetic technique is essential to ensure adequate pain control and ensure patient comfort during the procedure. It is important to take into account possible side effects or complications associated with the anesthetic techniques used, such as allergic reactions, neuropathies, or soft tissue injuries (Mathison & Pepper, 2022). Patient safety is a priority when selecting and applying anesthetic techniques.

In the case of the use of analgesic medication factor, it was determinat due to its ability to relieve pain, improve patient comfort, reduce inflammation, personalize treatment, and control pain in the long term. Proper selection and administration of analgesic medication are critical to successful pain management in dentistry. According to Wehler, et al. (2021), the proper use of analgesic medication can help control and alleviate the pain experienced by patients before, during, and after dental treatment. Furthermore, providing a comfortable patient experience is critical to overall well-being and patient satisfaction, and reducing inflammation not only relieves pain but also speeds up the healing process and decreases the risk of post-dental treatment complications. (Minich, and others, 2022).

Another determinant factor in the management of pain in dentistry was postoperative complications, this is so, due to its influence on the increase in pain, the need for additional interventions, the delay in recovery, the impact on quality of life, and the reassessment of the treatment plan. Pain management must address both the acute pain and the underlying complications to ensure a successful recovery and improve the patient experience. According to Kusiak, Jereczek-Fossa, Cichońska, & Alterio (2020), additional pain caused by postoperative complications may negatively affect the patient experience and require additional pain management measures. These additional interventions may

affect pain management and require adjustment to the initial treatment plan. According to Niemiec, et al. (2020), pain management in these cases should address both acute pain and underlying complications to facilitate optimal recovery.

The last factor classified as determinant in pain management in dentistry was anxiety and dental fear, due to its influence on pain sensitivity, patient cooperation, treatment seeking, mental health, and patient experience. Addressing these emotional issues is critical to providing successful dental care and minimizing associated pain. According to Kumar & Jalaluddin (2022), negative emotions and stress associated with anxiety and fear can increase the perception of pain and make the patient experience pain more intensely. Anxious or fearful patients may be more tense, have difficulty keeping their mouths open, or move involuntarily during treatment. This lack of cooperation can increase the risk of experiencing additional pain or complications during the procedure.

According to Van der Zande, Exley, Wilson, & Harris (2021), dental anxiety and fear can act as barriers for patients to receive the necessary dental treatment and can lead to dental avoidance, resulting in a delay in seeking dental care and deterioration of oral health. This can lead to increased pain and the need for more invasive or complex interventions at later stages. On the other hand, according to Jälevik, Sabel, & Robertson (2022), anxiety and dental fear not only affect pain management but also the mental health and general well-being of patients. Therefore, it is essential to address these emotional aspects during pain management in dentistry. Providing psychological support, relaxation techniques, education about the procedure, and conscious sedation options can help reduce anxiety and fear, which in turn improves the patient experience and facilitates pain management.

Regarding the factors that were classified as autonomous in pain management in dentistry, one of those is: Expectations and beliefs, this factor was placed in this category, due to its influence on pain perception, emotional reaction, decision-making, the placebo effect, and the active participation of the patient. Recognizing and addressing these expectations and beliefs can contribute to more effective pain management and improve the patient experience. In this regard, Poletti, Abdoun, Zorn, & Lutz (2021), state that if a patient has negative beliefs or pessimistic expectations about dental pain, they are more likely to experience pain more intensely and perceive it as more uncomfortable, similarly, if a patient believes that dental pain is unbearable or dangerous, they are more likely to experience significant fear, anxiety, or stress before and during treatment.

On the other hand, Hyland, et al. (2021), note that if a patient has positive expectations about pain management options, they are more likely to be willing to explore and use the recommended strategies. In this sense, in the context of dental pain management, a patient's beliefs and expectations may influence the perceived efficacy of analgesics or pain management techniques used. Recognition of the patient's expectations and beliefs allows active participation in pain management. This can help establish a strong and collaborative therapeutic relationship, as well as improve pain management outcomes.

Regarding the Social Support factor, it turned out to be autonomous in pain management in dentistry due to its ability to reduce stress, provide distraction and companionship, offer information and education, reinforce treatment adherence, and improve the patient's quality of life. Fostering a supportive environment and providing resources to access social networks can be beneficial for effective pain management and the general well-being of the patient. In this regard, Appukuttan (2016) points out that having someone present during dental treatment can help the patient to divert their attention from pain and feel more secure and comfortable. Likewise, Armfield & Heaton (2013) state that social support can help reduce dental anxiety and fear, which in turn can decrease the perception of pain and facilitate effective management of it. Feeling supported and surrounded by people who care about the patient's emotional and physical well-being can improve overall patient satisfaction, reduce feelings of isolation, and facilitate recovery.

For its part, the Coping Strategies factor was autonomous in pain management in dentistry due to its ability to control perceived pain, reduce anxiety and stress, improve attention and concentration, promote resilience, and empower the patient. Coping strategies can help patients have a greater sense

of control over perceived pain. According to Eiken, Nordanger, Nes, & Varsi (2022), by using appropriate coping techniques, such as distraction, muscle relaxation, or deep breathing, patients can feel that they have the tools to manage pain in dental treatments in a more effective way.

For their part, Alshatrat et al. (2022), state that by reducing anxiety and stress, the patient's experience can be improved and pain management facilitated. This can contribute to a more positive experience during dental treatment. On the other hand, resilience helps to maintain a positive attitude and greater confidence in the ability to overcome pain. By doing so, they feel more empowered and more actively involved in their dental pain management, which improves their sense of control and overall well-being.

The last factor that turned out to be autonomous was previous experiences, this is due to its influence on the expectations and anticipation of the patient, the emotional response, confidence and security, communication and feedback, as well as treatment decisions. Understanding and addressing the patient's previous experiences is critical to providing personalized pain management and improving the overall patient experience of dental procedures. According to Maggirias & Locker (2002), previous experiences influence the expectations and anticipation of the patient towards dental pain. If the patients have had negative or painful experiences in the past, they are likely to have pessimistic expectations and anticipation of severe pain from future dental procedures. On the other hand, if the patients have had previous positive or less painful experiences, they are more likely to have more optimistic expectations and less anticipation of pain.

On the other hand, McNeil, Vargovich, Sorrell, & Vowles (2014) state that previous experiences can affect the patient's emotional response to dental pain. If the patients have experienced severe or traumatic pain in the past, they may have a more intense emotional response, such as anxiety, fear, or stress, to current dental procedures. On the other hand, if previous experiences have been less painful, the emotional response is likely to be less intense. Likewise, Kohli, et al. (2022), explain that previous experiences impact patient confidence and safety concerning dental procedures and pain management. If the patients have had previous negative experiences, they may have less confidence in dental professionals and the pain management techniques used. Conversely, if they have had previous positive experiences, they are more likely to have greater confidence in the treatment process and in the dental team's ability to manage pain.

Finally, the quality of life turned out to be a dependent or result factor, since it is influenced by all the factors previously analyzed, such as the type of dental procedure, the duration of pain, the intensity of pain, the anesthetic techniques used, use of analgesic medication, postoperative complications, anxiety and dental fear, social support, coping strategies, and previous experiences. Quality of life refers to a person's general well-being and ability to enjoy their daily lives. In the context of dentistry and pain management, quality of life can be affected by the physical, emotional, and social impact of dental pain and related treatments.

In this sense, quality of life becomes an important outcome, as it reflects the overall impact of pain management on patients' lives. A better quality of life implies an improvement in the patient's ability to lead a full and satisfying life, which is a fundamental objective in the field of dentistry and pain management. In conclusion, quality of life is a dependent or result factor because it is the final result that is sought to be improved through the interdependence of all the clinical and psychosocial factors analyzed concerning pain management in dentistry.

Conclusions

In this study, a comprehensive analysis of the interdependence between clinical and psychosocial factors in pain management in dentistry was performed. Using the MICMAC methodology, the influence and interconnection of these factors concerning dental pain management were examined. The results of this analysis reveal the importance of considering both clinical and psychosocial aspects to achieve effective pain management and improve the quality of life of patients. Clinical factors such as the type of dental procedure, the intensity and duration of pain, the anesthetic techniques used, and the use of analgesic medication have been shown to play a crucial role in pain management in

dentistry. These factors are closely interrelated and their proper consideration can result in a significant reduction in pain experienced by patients.

Likewise, psychosocial factors also play a relevant role in the management of dental pain. Anxiety and dental fear, social support, coping strategies, and previous patient experiences, influence pain perception and tolerance, as well as overall quality of life. Understanding these factors and their interaction can help dental professionals develop more personalized and effective approaches to pain management. However, it is important to consider the limitations of this study, for example, the MICMAC technique has its limitations, such as the dependence on the relationships established in the matrix and the subjective interpretation of the results.

Despite this limitation, this study provides a comprehensive perspective on pain management in dentistry by considering the interdependence between clinical and psychosocial factors. The results highlight the importance of a multidimensional approach to address dental pain, recognizing both the physical and psychosocial aspects. This broader understanding can contribute to improving the quality of life of patients and providing more effective dental care. The clinical implications of this study are significant. Dental professionals can use these findings to develop more personalized and effective pain management strategies, tailored to each patient's individual needs and circumstances. Consideration of the clinical and psychosocial factors discussed in this study may improve the patient experience, reduce anxiety and fear associated with dental treatment, and improve pain management outcomes.

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