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ORIGINAL RESEARCH

Perception of forensic Odontologists on the usefulness of palatal Rugoscopy in Ecuador

Percepción de peritos en Odontología forense sobre la utilidad de la Rugoscopía palatina en Ecuador

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ABSTRACT

Human identification is a fundamental process within forensic sciences, particularly in contexts where traditional identification methods are limited or inconclusive. In this framework, forensic odontology provides complementary techniques such as palatal rugoscopy, which is based on the morphological analysis of palatal rugae due to their individualizing characteristics and relative stability over time. The aim of this study was to analyze the perception of forensic odontologists regarding the usefulness of palatal rugoscopy as a method for human identification in Ecuador. A quantitative, descriptive, cross-sectional study was conducted. The population consisted of seven forensic odontologists, corresponding to the entire identified universe, who completed a structured questionnaire using a Likert-type scale. Data was analyzed using descriptive statistics, including absolute frequencies and percentages. The results revealed a predominantly favorable perception of palatal rugoscopy, mainly recognized as a complementary method in human identification processes, with agreement levels ranging from 71.4% to 100%. However, the experts also identified significant limitations, such as the lack of technical regulations and standardized protocols, the absence of antemortem records, and gaps in specialized training. It is concluded that palatal rugoscopy has potential forensic value in the Ecuadorian context, provided that standardized protocols, specialized training, and institutional integration within the human identification system are strengthened.
Keywords: Palatal rugoscopy. Forensic odontology. Human identification. Forensic experts.

RESUMEN

La identificación humana constituye un proceso esencial en las ciencias forenses, particularmente en contextos donde los métodos tradicionales resultan limitados. En este marco, la odontología forense aporta técnicas complementarias como la rugoscopía palatina, basada en el análisis morfológico de las rugas palatinas por su carácter individualizante y relativa estabilidad. El objetivo del presente estudio fue analizar la percepción de peritos en odontología forense sobre la utilidad de la rugoscopía palatina como método de identificación humana en Ecuador. Se desarrolló una investigación de enfoque cuantitativo, con diseño descriptivo y corte transversal. La población estuvo conformada por siete peritos odontológicos forenses, correspondientes al total del universo identificado, a quienes se aplicó un cuestionario estructurado con escala tipo Likert. Los datos fueron analizados mediante estadística descriptiva, utilizando frecuencias absolutas y porcentajes. Los resultados evidenciaron una percepción mayoritariamente favorable hacia la utilidad de la rugoscopía palatina, reconocida principalmente como método complementario en procesos de identificación humana, con niveles de acuerdo entre el 71,4 % y el 100 %. No obstante, los peritos identificaron limitaciones relevantes, como la ausencia de normativas y protocolos técnicos, la falta de registros antemortem y brechas en formación especializada. Se concluye que la rugoscopía palatina posee un valor forense potencial en el

contexto ecuatoriano, condicionado a la implementación de protocolos estandarizados, fortalecimiento de la capacitación profesional e integración institucional dentro del sistema de identificación humana.
Palabras clave: Rugoscopía palatina. Odontología forense. Identificación humana. Peritos forenses.

INTRODUCTION

Human identification constitutes one of the fundamental processes within the field of forensic sciences, as it allows the establishment of the identity of individuals involved in judicial, criminal, humanitarian, and administrative contexts. This process becomes particularly relevant in situations of violent death, mass disasters, irregular migration, armed conflicts, or events in which human remains exhibit high degrees of deterioration, fragmentation, or alteration. In such scenarios, traditional identification methods, such as fingerprint analysis and DNA testing, although still considered reference standards, are not always applicable due to the absence of viable tissues, the lack of comparative records, or the logistical and economic limitations inherent to certain national contexts [(1)(2)].

Within this framework, forensic odontology has become a strategic discipline within the human identification system, providing methods based on the resistance of oral and maxillofacial structures, as well as on the individuality of their anatomical characteristics. Odontological analysis allows for the identification of both living and deceased individuals, even under extreme conditions such as carbonization, advanced decomposition, or severe trauma. Among the techniques employed are the analysis of dental records, odontometry, cheiloscopy, and palatal rugoscopy, the latter being recognized for the unique morphological characteristics of palatal rugae [(3)].

Palatal rugoscopy is based on the study of palatal rugae, which are transverse mucosal folds located in the anterior region of the hard palate, whose shape, arrangement, and pattern exhibit individual variations comparable to an “anatomical fingerprint.” Numerous studies have demonstrated that these structures develop early in life, maintain relative stability over time, and are anatomically protected from external factors, which confers them significant potential for human identification [(4)(5)]. These characteristics have motivated their inclusion as a complementary method in human identification, particularly when other procedures cannot be applied effectively.

Nevertheless, despite the scientific evidence supporting its anatomical foundations, the application of palatal rugoscopy in forensic practice remains limited and heterogeneous, particularly in Latin American countries. Recent literature indicates that its use faces multiple challenges, including the absence of standardized protocols, limited availability of antemortem records, variability in classification methods, and insufficient specialized training among forensic professionals [(6)(7)]. These difficulties have generated debate regarding its reliability, reproducibility, and evidentiary value within judicial systems.

In the Ecuadorian context, this issue is further exacerbated by the lack of specific regulations governing the use of complementary odontological techniques in human identification processes, as well as by the absence of systematized databases that include palatal records. Although forensic odontology is part of the expert system, the use of methods such as palatal rugoscopy largely depends on professional judgment, the individual experience of the expert, and the specific conditions of each case. This situation highlights a gap between the theoretical development of the method and its practical implementation within the national forensic system.

Within this scenario, the perception of forensic odontologists plays a central role in understanding the actual usefulness of palatal rugoscopy. Professional perception not only reflects the degree of acceptance or skepticism toward a given technique, but also integrates accumulated experience, technical knowledge, operational limitations, and the demands of the legal context in which expert practice is carried out [(8)]. Analyzing these perceptions makes it possible to identify strengths, weaknesses, and opportunities for improvement, providing relevant information for institutional decision-making, the planning of training programs, and the design of technical protocols.

Several recent studies have emphasized the need to incorporate expert opinion–based approaches to assess the applicability of emerging or complementary forensic methods, particularly in contexts where empirical evidence remains limited [(9)(2)]. From this perspective, exploring the perception of forensic odontological experts in Ecuador regarding the usefulness of palatal rugoscopy represents a relevant contribution to the field of forensic odontology, as it provides contextualized evidence that may contribute to strengthening human identification processes and consolidating this technique within expert practice.

MATERIALS AND METHODS

A quantitative study with a descriptive, cross-sectional design was conducted to analyze the perception of forensic dentistry experts regarding the usefulness of palatal rugoscopy as a method of human identification in the Ecuadorian context. The quantitative approach allowed for the systematic description of participants’ opinions through the measurement of perceptual variables, while the descriptive design was appropriate for characterizing trends, levels of agreement, and professional criteria without establishing causal relationships [(10)].

The study population consisted of seven (7) forensic odontologists accredited by the Council of the Judiciary who perform expert forensic functions in Ecuador and had direct experience in human identification processes. Given that the number of identified experts was limited and that access to the entire group was available, the study followed a census approach. Applying the data collection instrument to 100% of the population, without resorting to sampling procedures. The unit of analysis was each participating in forensic odontologist. The census nature of the study allowed for the comprehensive collection of perceptions from all individuals comprising the target population, eliminating sampling error and strengthening the internal validity of the results within the specific context analyzed.

The technique employed was a survey, selected for its usefulness in exploring perceptions, attitudes, and professional assessments in descriptive studies. The instrument consisted of a structured questionnaire specifically designed for the study, composed of closed-ended questions organized using a five-point Likert-type scale (strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, and strongly disagree), as well as questions related to professional characterization.

The questionnaire addressed dimensions related to academic training and forensic experience; perception of the usefulness of palatal rugoscopy; applicability of the method in human identification processes; technical, regulatory, and operational limitations; and recommendations for strengthening its use in the Ecuadorian context. The use of Likert scales is appropriate for capturing gradients of perception and has been widely validated in research on expert judgment and professional evaluation in forensic and health sciences [11].

Data collection was carried out at a single point in time using Google Forms. The questionnaire was administered individually to each expert, ensuring homogeneous application conditions. Prior to participation, the objective of the study and its academic nature were explained to all participants. Participation was voluntary, and no financial incentives were offered. Once the surveys were collected, the information was reviewed to verify completeness and coherence, after which responses were coded for subsequent analysis. The data obtained was processed using descriptive statistics, including absolute frequencies and percentages. Given that the size of the study population was seven participants, each response represented an approximate percentage value of 14.3%. The results were organized and presented in tables in accordance with the article's formatting standards, to facilitate interpretation and analysis.

No inferential statistical tests were applied, as the objective of the study was not statistical generalization, but rather the description of the professional perceptions of all included experts, in accordance with the census design of the study. The study was conducted in accordance with the ethical principles of research in the health and social sciences. Confidentiality of the information, anonymity of the participants, and the exclusive use of the data for academic and scientific purposes were guaranteed. In addition, informed consent was obtained from all experts prior to the application of the instrument, ensuring their right to participate freely and voluntarily, in accordance with international ethical recommendations for research involving human subjects [12].

RESULTS

The results are presented through descriptive statistical analysis, considering absolute frequencies and percentages corresponding to the total study population (n = 7). The professional characteristics of the experts, their perception of the usefulness of palatal rugoscopy, the identified limitations, and the recommendations for strengthening its use in the Ecuadorian forensic context are described.

Table 1. Sociodemographic and professional characterization of the experts

Variable	Category	n	%
Years of forensic experience	0–2 years	2	28.6
	6–10 years	3	42.9
	More than 10 years	2	28.6
Academic background	Specialization	1	14.3
	Master's degree	4	57.1
	No forensic postgraduate training	2	28.6

Source: Surveys administered to forensic dentistry experts. Ecuador, 2025. Authors' elaboration.

The study population consisted of seven (7) forensic odontologists accredited by the Council of the Judiciary, representing 100% of the identified population; therefore, the results reflect the entirety of the perceptions of the analyzed group. Regarding years of forensic experience, 42.9% (n = 3) of participants reported having between 6 and 10 years of experience, while 28.6% (n = 2) indicated more than 10 years of professional practice. The remaining 28.6% (n = 2) reported having 0 to 2 years of experience. This distribution demonstrates

the participation of experts with consolidated professional trajectories as well as others in the initial stages of forensic practice (Table 1). With respect to academic background, 57.1% (n = 4) of the experts reported holding a master's degree in areas related to forensic odontology or allied sciences, 14.3% (n = 1) indicated having a specialization, while 28.6% (n = 2) reported not having specific postgraduate training in the forensic field. These results reflect a predominance of advanced academic training, although relevant academic gaps within the group are also evident (Table 1).

Table 2. Perception of the usefulness of palatal rugoscopy as a method of human identification

Evaluated item	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Palatal rugoscopy is useful for human identification	5 (71.4%)	2 (28.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: Surveys administered to forensic dentistry experts. Ecuador, 2025. Authors' elaboration.

Regarding the usefulness of palatal rugoscopy as a method of human identification, 71.4% (n = 5) of the experts reported being strongly in agreement with its usefulness in the forensic field, while 28.6% (n = 2) indicated being somewhat in agreement. No responses were recorded in the neutral or disagreement categories. These findings demonstrate a positive and homogeneous trend in the experts' assessment of the method. When analyzing the perception of palatal rugoscopy as a complementary method in cases where other identification procedures are not viable, 85.7% (n = 6) expressed being strongly in agreement, while 14.3% (n = 1) fell into the somewhat in agreement category. The absence of negative responses reinforces the favorable perception of the method as an auxiliary resource within the forensic odontological techniques arsenal (Table 2).

Table 3. Perception of palatal rugoscopy as a complementary method of identification

Evaluated item	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Palatal rugoscopy is useful as a complementary method when other methods are not viable	6 (85.7%)	1 (14.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: Surveys administered to forensic dentistry experts. Ecuador, 2025. Authors' elaboration.

Regarding the limitations for the application of palatal rugoscopy in Ecuador, 100% (n = 7) of the experts agreed in identifying the absence of official regulations and standardized protocols as one of the main barriers to its systematic implementation. Likewise, 85.7% (n = 6) identified the lack of antemortem records and palatal databases as a significant obstacle to its practical use in human identification processes. Additionally, 71.4% (n = 5) of participants indicated that there is limited technical knowledge and specialized training in the technique within the forensic system, while 57.1% (n = 4) pointed to insufficient institutional integration among the entities responsible for human identification as a factor restricting its application. These findings indicate that the main perceived limitations are related to structural and organizational factors rather than to inherent deficiencies of the method itself (Table 3).

Table 4. Perceived limitations for the application of palatal rugoscopy in Ecuador

Identified limitations	n	%
Absence of official regulations and standardized protocols	7	100.0
Lack of antemortem records and databases	6	85.7
Limited specialized technical training	5	71.4
Insufficient institutional integration	4	57.1

Source: Surveys administered to forensic dentistry experts. Ecuador, 2025. Authors' elaboration.

Regarding the actions necessary to strengthen the use of palatal rugoscopy, 100% (n = 7) of the experts stated that they strongly agreed with the need to establish standardized technical protocols at the national level. Likewise, 85.7% (n = 6) considered it a priority to strengthen academic training and continuous professional development of experts in this technique. Additionally, 71.4% (n = 5) is recommended incorporating palatal rugoscopy into institutional human identification procedures, while 57.1% (n = 4) emphasized the importance of promoting research lines and developing palatal databases as key strategies for its consolidation within the Ecuadorian forensic context. Table 4.

Table 5. Recommendations to strengthen the use of palatal rugoscopy in the Ecuadorian forensic context

Proposed recommendations	n	%
Establish standardized technical protocols	7	100.0
Strengthen specialized education and training	6	85.7
Incorporate the technique into institutional procedures	5	71.4
Develop palatal databases and applied research	4	57.1

Source: Surveys administered to forensic dentistry experts. Ecuador, 2025. Authors' elaboration.

A relevant consensus is observed among forensic dentistry experts regarding the actions necessary to strengthen the use of palatal rugoscopy in Ecuador. One hundred percent of participants consider the establishment of standardized technical protocols to be essential, indicating that the main perceived limitation is of a regulatory nature. Likewise, 85.7% highlight the need to strengthen specialized education and training, reflecting gaps in technical preparation for the systematic application of the technique. Additionally, 71.4% recommend incorporating palatal rugoscopy into institutional human identification procedures, while 57.1% emphasize the importance of developing palatal databases and promoting applied research. Taking together, these results indicate that institutional strengthening is key to consolidating this technique (Table 5). Overall, the statistical results demonstrate a highly favorable perception among forensic dentistry experts regarding the usefulness of palatal rugoscopy, with agreement levels ranging from 71.4% to 100% across the different dimensions evaluated. At the same time, clearly defined structural limitations were identified and recognized by more than 70% of participants, underscoring the need for regulatory, educational, and institutional interventions to enhance the application of the method.

DISCUSSION

The findings of the present study show a highly favorable trend toward palatal rugoscopy as a human identification resource in Ecuador; however, they also demonstrate that its implementation largely depends on structural conditions, including technical standardization, specialized training, institutional incorporation, and the availability of antemortem records. This pattern is consistent with recent international literature, which recognizes the identificatory potential of palatal rugae due to their individualizing nature and relative anatomical protection, but also warns that their evidentiary value is strengthened only when a robust, reproducible methodological framework supported by comparable records is in place (13)(14).

Regarding the unanimous recommendation to establish standardized technical protocols (100%), international evidence indicates that one of the major obstacles to consolidating palatal rugoscopy as a forensic method lies in the heterogeneity of recording, analysis, and classification systems, which increases interobserver variability and limits comparability among experts, institutions, and countries [(13)]. In this regard, the transition toward digital approaches—including intraoral scanning and three-dimensional analysis—has been proposed as a pathway to improve objectivity, reduce bias, and increase reproducibility, particularly in complex or large-scale identification scenarios [(15)]. Thus, the local consensus on the need for protocols aligns with an international trend promoting the formalization of standardized and auditable workflows.

The high priority assigned by experts to specialized education and training (85.7%) is also consistent with recent literature, which suggests that the actual usefulness of the method depends not only on the anatomical stability of palatal rugae, but also on the technical competence of the evaluator, standardized recording procedures, and interpretation based on comparable criteria. Contemporary reviews emphasize that palatal rugoscopy may play a particularly valuable complementary role in resource-limited settings or in cases where traditional identification methods are unfeasible; however, its proper application requires specific training, familiarity with both conventional and digital recording methods, and clearly defined ante-/postmortem comparison criteria [(14)(13)]. Consequently, the emphasis placed by Ecuadorian experts on training may be interpreted as an enabling condition for the technique to evolve from a theoretical resource into an operational tool within the forensic system.

With respect to the recommendation for institutional incorporation into formal identification procedures (71.4%), international literature shows that methods based on palatal morphology gain greater value when integrated into organized identification systems and standardized documentation strategies. Advances in three-dimensional comparison and automated alignment have reinforced discussions on the feasibility of incorporating palatal records into digital databases and more rapid and reproducible identification workflows. For example, recent studies on palatal morphology–based identification describe three-dimensional comparison approaches aimed at increasing accuracy and process consistency, supporting the notion that institutionalization of the method additionally requires recording infrastructure, interoperability, and standardized protocols [(16)]. Although the present study focuses on perception rather than technical

validation, the convergence between local recommendations and global innovation suggests that Ecuador could benefit from progressive integration strategies, beginning with standardization and training and advancing toward digitalization and database development.

The less frequently mentioned—though still majority—recommendation to develop palatal databases and applied research (57.1%) reveals a critical issue widely discussed in the literature: the need for antemortem data to support comparative analysis. International evidence emphasizes that, without prior records (models, scans, or images), palatal rugoscopy loses strength as an individual comparative method and becomes limited to descriptive approaches. In line with this, systematic reviews underline that the reliability of the method increases when comparable ante- and postmortem records exist and when validated metrics and procedures are applied [13].

Therefore, the moderate level of interest in database development may be explained by the perception that its implementation requires greater institutional effort, including infrastructure, regulation, interoperability, and data management, although it remains an essential component for the long-term consolidation of the method. A central aspect of international discussion—and relevant for interpreting the caution expressed by some experts—is the stability of palatal rugae in the presence of dental interventions, particularly orthodontic treatments. Recent literature, including systematic reviews, warns that procedures such as palatal expansion may generate morphological or dimensional changes that affect the reliability of superimpositions and comparisons, recommending caution in patients with a history of expansion and proposing the selection of more stable reference areas [16]. Likewise, meta-analyses on the influence of orthodontic treatments indicate that, although morphology may remain identifiable in many cases, quantitative changes do occur, requiring cautious interpretation of results and favoring combined approaches [17]. These considerations reinforce the need—already highlighted by experts—for protocols, training, and institutional integration, since accurate forensic interpretation requires accounting for clinical confounding factors and therapeutic histories.

In summary, the profile of recommendations derived from Ecuadorian forensic odontologists is consistent with recent international evidence: palatal rugoscopy is primarily valued as a complementary method with forensic potential, whose practical performance is optimized when supported by standardization, technical competence, comparable records, and increasingly, digital tools that enhance reproducibility. Accordingly, the literature also suggests that its implementation should be gradual, guided by methodological validation, clearly defined usage scenarios, and articulation with other identification methods. In the Ecuadorian context, the results suggest that the main challenge is not the acceptance of the method, but its institutionalization—transforming a potentially useful technique into a technically sound, normatively supported, and operationally integrable procedure within the human identification system [14][13][16].

CONCLUSIONS

The present study made it possible to analyze the perception of forensic odontologists regarding the usefulness of palatal rugoscopy as a method of human identification in Ecuador, revealing a predominantly favorable professional assessment of this technique. The results indicate that experts recognize its identificatory potential, particularly as a complementary method in contexts where traditional procedures cannot be applied or prove insufficient, thereby confirming the fulfillment of the general objective of the research.

With respect to the specific objectives, a high level of agreement regarding the usefulness of palatal rugoscopy was observed, reflecting professional acceptance grounded in forensic experience and knowledge of its anatomical foundations. This positive perception is not based on systematic empirical application, but rather on recognition of its theoretical characteristics and its potential contribution in complex forensic scenarios. In addition, the study clearly identified the main limitations affecting the application of the method in the Ecuadorian context, notably the absence of official regulations and technical protocols, the lack of antemortem records and palatal databases, and gaps in specialized training. These limitations confirm that the obstacles to implementation are not inherent to the technique itself, but rather structural, regulatory, and institutional in nature.

Likewise, a significant consensus among experts was evident regarding the need to strengthen standardization, professional training, and institutional integration of palatal rugoscopy within human identification processes. These recommendations are consistent with recent international scientific literature and reinforce the relevance of moving toward regulated and technically validated models of application.
Finally, it is concluded that palatal rugoscopy has potential forensic value in the Ecuadorian context, conditioned upon the implementation of institutional policies, technical protocols, and specialized training programs. From the experts' perspective, consolidation as a complementary method would contribute to strengthening the human identification system, if it is developed under clearly defined scientific, ethical, and regulatory criteria.

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AUTHOR CONTRIBUTIONS

"*Conceptualization and design:* Eva Mascaró and Carlos Martínez; *Literature review:* Thalía Álvarez; *Methodology and validation:* Ángela Gaibor; *Formal analysis:* Eva Mascaró; *Investigation and data collection:* Thalía Álvarez; *Resources: Not applicable; Data analysis and interpretation:* Ángela Gaibor; *Writing – original draft preparation:* Thalía Álvarez; *Writing – review and editing:* Thalía Álvarez; *Supervision:* Carlos Martínez; *Project administration:* Not applicable; *Funding acquisition:* Not applicable."

CONFLICTS OF INTEREST

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