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BIBLIOGRAPHIC STUDY OF PAWON MAN FORENSIC ODONTOLOGY RESEARCH AT UNIVERSITAS PADJADJARAN, INDONESIA

Felia Resha Wulandari[1)], Lutfi Yondri[2)], Suhardjo[3)], Deby Fajar Mardhian[4)], Sri Susilawati[5)], Fahmi Oscandar[6)*]

[1)]Master in Dentistry Program Forensic Odontology, Faculty of Dentistry, Universitas Padjadjaran
Sekeloa Selatan Street No.1, Bandung, 40132, Indonesia
[2)]Badan Riset dan Inovasi Nasional (BRIN)
Sangkuriang Street, Bandung, 40135, Indonesia
[3)]Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Universitas Padjadjaran
Sekeloa Selatan Street No.1, Bandung, 40132, Indonesia
[4)]Department of Dental Materials Science and Technology, Faculty of Dentistry, Universitas Padjadjaran
Sekeloa Selatan Street No.1, Bandung, 40132, Indonesia
[5)]Department of Dental Public Health, Faculty of Dentistry, Universitas Padjadjaran
Sekeloa Selatan Street No.1, Bandung, 40132, Indonesia
[6)]Department of Oral and Maxillofacial Radiology-Forensic Odontology, Faculty of Dentistry, Universitas Padjadjaran
Sekeloa Selatan Street No.1, Bandung, 40132, Indonesia
)Pos-el: fahmi.oscandar@unpad.ac.id (corresponding author)

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Abstract

Discovery of Pawon Man provide valuable insights into the region's history. Despite various studies conducted, there is a notable lack of comprehensive identification and systematic review of Pawon Man's teeth. This study aims to map the development of research on Pawon Man in the field of forensic odontology, which contributes to the understanding of human history in West Java. The method used is descriptive analysis, examining technology applied in research by analysing relevant references from 2012 to 2024. 3D Cone Beam Computed Tomography (CBCT) was the method used in 16 studies due to its non-destructive and high accuracy. Scanning Electron Microscope (SEM) provided in-depth insights into dental calculus, revealing information about ancient health and dietary practices. In a review of 33 articles, the study also highlighted age estimation as a crucial aspect of biological profiling. Despite extensive research, there are still variables that require further investigation, including accuracy in age estimation and contributing factors to the absence of dental caries. Interdisciplinary collaboration is essential to address these issues and enrich the understanding of Pawon Man. Future studies should prioritise interdisciplinary approaches and the use of advanced technology.

Keywords: Pawon Man, forensic odontology, Indonesia, bibliographic

INTRODUCTION

According to Regional Regulation of West Java Province No. 2 of 2006 Pawon Cave is designated as a significant cultural and scientific heritage site situated in West Bandung Regency, West Java (Pemerintah Provinsi Jawa Barat 2006). The initial research at Pawon Cave was conducted by Benthem Jutting in 1950 (Sumaludin 2021). Since 2003, the discovery of seven human skeletons, dating from 5600 to 11780 Before Present (BP), has been made. The human skeletons found are referred to as Pawon Man (Suganda 2011). These findings offer valuable insights into the human history of Western Java and Western Indonesia more broadly. However, research on the teeth of Pawon Man has been partially conducted by various researchers since 2012.

Forensic odontology is a specialized field within dentistry that intersects with legal investigations by handling and examining dental evidence. Forensic odontologists are responsible for identifying human remains through the analysis of dental records, interpreting lifestyle and dietary patterns from archaeological findings, and determining age, sex, and ancestry in both living and deceased individuals (Jayakrishnan, Reddy, and Vinod Kumar 2021). Teeth, as archaeological artifacts, can provide crucial information for identifying species, assessing age, diagnosing pathological conditions, and understanding diet (Dobney and Brothwell 1987). Nevertheless, a comprehensive identification of Pawon Man's teeth has not been fully achieved. Ongoing studies are essential for advancing our understanding of the historical and anthropological context of the West Java region.

Researchers in Indonesia have undertaken various studies on Pawon Man, producing a range of research articles, books, and other publications. Therefore, by compiling these results into a comprehensive bibliography, the research can be systematically organized and extensively discussed. This method not only integrates insights from multiple sources but also serves as an invaluable reference, elucidating the connections between various research findings and enhancing our overall understanding of the topic.

Although various studies have been conducted, there remains a lack of bibliographic reviews addressing the variables and technologies employed in research on prehistoric humans. This study aims to fill that gap by providing a detailed review of the scientific research data related to Pawon Man. Focusing on empirical studies within the field of forensic odontology, this research seeks to map the evolution of studies concerning Pawon Man. As a result, it aims to contribute to our understanding of human history in the West Java region.

METHOD

The descriptive research design was done to describe subjects through interpretative procedures that analyse the meanings of non-numerical data related to a specific focus object, often utilizing qualitative descriptive analysis techniques (Haryoko, Bahardian, and Arwadi 2020). The observation period spans from 2012 to 2024, during

which relevant journal articles, research papers, and other scholarly works were gathered. Data sources include Google Scholar, Universitas Padjadjaran Library website (lib.unpad.ac.id) and the Library of the Department of Forensic Odontology, Faculty of Dentistry, Universitas Padjadjaran. The search process through online data utilized specific keywords such as "Pawon Man," "Pawon Man tooth," and "gigi Manusia Pawon" to focus the results on studies related to forensic odontology and Pawon Man. Articles that did not align with the forensic focus were excluded after a thorough review of titles, abstracts, and content. The selection criteria focused on works that addressed Pawon Man within the context of dental and oral studies. Primary method used for data analysis in this study is content analysis, a versatile technique applicable to qualitative data. Despite its flexibility, the lack of clear guidelines for data analysis presents challenges for researchers (Elo and Kyngäs 2008).

Similar to other research studies, the implementation of descriptive methods will be conducted in a systematic manner, comprising three distinct stages (Doyle et al. 2020). The first stage involved sampling which is the process of selecting which non-relevant articles were excluded, and only studies directly addressing forensic odontology in relation to Pawon Man were retained. The aim is to gather in-depth information through techniques like purposive sampling, which targets can provide insights aligned with the research objectives. The second stage is data collection. After filtering the relevant articles, data were organized in a structured format, such as charts or matrices, to facilitate interpretation. Remaining data were organized into thematic categories based on the identified aspects of forensic odontology, such as variables and technology used. Key themes related to forensic odontology aspects of Pawon Man were highlighted during this stage. The goal is to collect rich and comprehensive data. In the final stage, data analysis and interpretation. Data analysis involves processing and interpreting the collected data to identify patterns, themes, and meanings. Commonly used analysis techniques include content analysis and thematic analysis, which help researchers organize and understand the data systematically. Interpretation is the stage where researchers transform unprocessed data into meaningful findings. This involves a deeper understanding of the data, aiming to generate insights that can be applied in practice, particularly in the archaeology and healthcare field.

RESULTS AND DISCUSSION

Results

The results included scientific papers which were then systematically categorized by year, reference source, technology, and variables studied. A search of the database found 33 relevant sources. After screening the titles and abstracts, duplicate entries were removed. The bibliography was compiled based on the data collected, which was then processed to identify connections between authors, subjects, publications, and technologies.

For this study, Google Scholar and direct library access were selected as primary sources for journal articles due to the limited number of studies on Pawon Man, which have primarily been conducted within Indonesia. Google Scholar provides access to a wide range of academic articles from Indonesian sources, while direct library access supplements this by offering local resources that may not be available online. By utilizing these two sources, the study aims to ensure a more comprehensive investigation of the available literature on Pawon Man, focusing specifically on research conducted within Indonesia.

Table 1. Pawon Man studies list in 2012 – 2024

No	Author	Year	Title	Reference Source	Technology	Variable
1	Senjaya, T., *et al*. (Senjaya, Oscandar, and Yondri 2012)	2012	Difference of the size of average crown width first molar and second molar mandible of the Pawon Man with modern man	Padjadjaran Journal of Dentistry	CBCT 3D Ez Implant 3D Program	Tooth size (crown length)
2	Rajabi, G.U.(Rajabi 2016)	2016	*Deskripsi* Oral Hygiene *Manusia Pawon*	Undergraduate thesis	Clinical examination	Oral hygiene
3	Ismanto, T.L.(Ismanto 2016)	2016	*Gambaran perbandingan tinggi mahkota dan panjang akar gigi Manusia Pawon dengan manusia modern menggunakan* Cone Beam Computed Tomography *3D*	Undergraduate thesis	CBCT 3D Ez Implant	Tooth size
4	Yazidah, F.I. (Yazidah 2016)	2016	*Deskripsi mandibula Manusia Pawon menggunakan Data Fotografi*	Undergraduate thesis	Photography ImageJ software	Size of mandible
5	Desrilyana, A.(Desrilyana 2016)	2016	*Perbandingan Morfometrik Korpus Mandibula Manusia Pawon dengan Manusia Modern Suku Sunda Usia 25 – 35 Tahun menggunakan CBCT 3D*	Undergraduate thesis	CBCT 3D Ez Implant	Size of mandible
6	Mun, N.K. (Mun 2016)	2016	Determination of mandibular dental arch shape to identify the race of skeletal remains of Pawon Man	Undergraduate thesis	DICOM Slices ImageJ	Race
7	Carolina, N.(Carolina. Natasha 2016)	2016	*Deskripsi Pola Fisur Oklusal Gigi Molar Pada Kerangka Manusia Pawon*	Undergraduate thesis	Free Trial Map Info Pro v.15.2	Tooth pattern
8	Hardianto, S.R.(Hardianto 2016)	2016	*Estimasi Usia Manusia Pawon Dengan Metode Kvaal Menggunakan Data* Cone Beam Computed Tomography *3D*	Undergraduate thesis	CBCT 3D	Age estimation
9	Artia, D.P.(Artia 2016)	2016	*Estimasi Usia Manusia Pawon Berdasarkan Konversi Pola Atrisi Gigi Manusia Modern (Deutro Melayu) Dengan Menggunakan* CBCT 3D	Undergraduate thesis	CBCT 3D Ez Implan	Age estimation

10	Elizabeth	2016	*Estimasi Usia Manusia Pawon melalui Identifikasi Gigi dengan Metode Johanson pada Radiograf* CBCT 3D	Undergraduate thesis	CBCT 3D	Age estimation
	Elizabeth, et al.(Elizabeth et al. 2018)	2018	Age Estimation Of Pawon Men Through Teeth Identification Using Johanson Method Through CBCT 3D Radiograph	AMERTA, Jurnal Penelitian dan Pengembangan Arkeologi		
11	Sandran, M.(Sandran 2016)	2016	The condyle description in Pawon Man	Undergraduate thesis	Clinical examination	Size of mandible (condyle)
12	Rizqullah W.(Rizqullah et al. 2016)	2016	*Gambaran Ketebalan dan Densitas Tulang Kortikal Maksila Dan Mandibula Manusia Pawon Dengan Pencitraan* Cone Beam Computed Tomography 3D (Description of Pawon Man's maxillary and mandibular cortical bone thickness and density with 3D Cone Beam Computed Tomography imaging)	PURBAWIDYA: Jurnal Penelitian Dan Pengembangan Arkeologi	CBCT 3D Ez Implant 3D Program	Cortical bone thickness and density
13	Handoko, I.D.(Handoko 2016)	2016	*Identifikasi Usia Manusia Pawon 5600 sd 9500 BP Berdasarkan Pola Atrisi Gigi Metode Lovejoy Dengan Menggunakan* CBCT 3D	Undergraduate thesis	CBCT 3D Ez Implant 3D Program Lovejoy Method (age estimation)	Age estimation
14	Khairani, A.(Khairani 2016)	2016	*Pemeriksaan Pati pada Kalkulus Gigi Manusia Pawon*	Undergraduate thesis	Mikroskop	Dental calculus
15	Putranto, A.N.(Putranto 2016)	2016	*Persentase Trabekula Maksila dan Mandibula Pada Kerangka Manusia Pawon Menggunakan* CBCT 3D	Undergraduate thesis	CBCT 3D Ez Implant 3D Program	Trabecula percentage
16	Putri, A.M.(Putri 2016)	2016	*Identifikasi jenis kelamin berdasarkan lebar gigi kaninus mandibula kiri Manusia Pawon menggunakan pendekatan rumus* Discriminant Canine Index	Undergraduate thesis	Digital caliper Discriminant Canine Index Formula	Sex determination
17	Nugrahaningrum (Nugrahaningrum 2016)	2016	*Deskripsi Bentuk Lengkung Gigi Mandibula Rangka Manusia Pawon sebagai Identifikasi Jenis Kelamin Berdasarkan Data* Cone Beam Computed Tomography 3D	Undergraduate thesis	CBCT 3D Ez Implant	Sex determination
18	Qotrunnada, N.(Qotrunnada 2016)	2016	*Teknik Analisis* Deoxyribose Nucleic Acid (DNA) *Bakteri Dari Kalkulus Gigi Pada Rangka*	Undergraduate thesis	Literature review	Bacteria DNA analysis

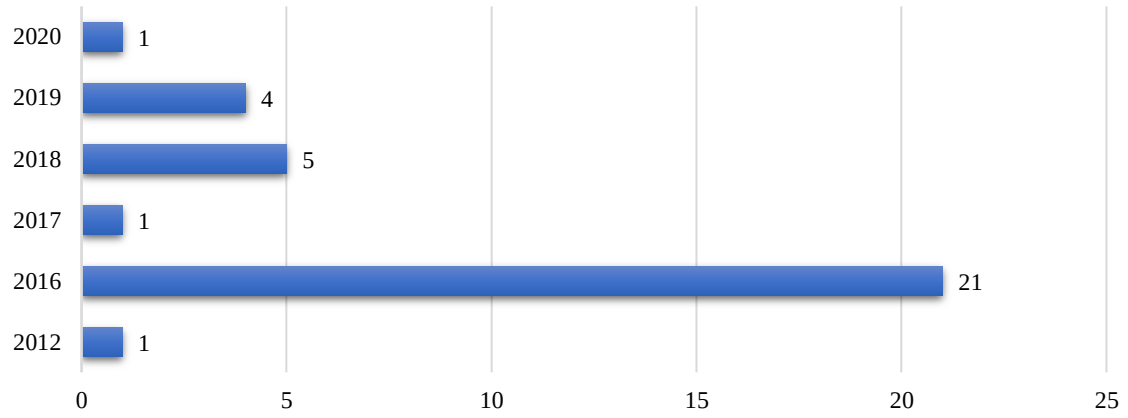
			Manusia Untuk Pendekatan Studi Pendahuluan Manusia Pawon			
19	Alhadad, S.A.K.(Alhadad 2016)	2016	The determination about the best techniques for DNA analysis on Pawon Man (Literature Review)	Undergraduate thesis	Literature review	DNA analysis
20	Georandhi, R.G.(Georandhi 2016)	2016	*Morfometrik Gigi Rangka Manusia Pawon Menggunakan Data* CBCT 3D	Undergraduate thesis	CBCT	Tooth morphometric
21	Kamilah, J.(Kamilah 2016)	2016	Description Oral Pathological Conditions of Pawon Man	Undergraduate thesis	Clinical examination CBCT 3D	Pathological conditions of the teeth (attrition, recession, hypersementosis)
22	Fauzan, M.I.(Fauzan 2016)	2016	*Gambaran Densitas Tulang Alveolar Kerangka Manusia Pawon Menggunakan Radiografi* CBCT 3D	Undergraduate thesis	CBCT 3D Ez Implant 3D Program	Alveolar bone density
	Fauzan, M.I.(Fauzan et al. 2019)	2018	*Identifikasi Pola Makan Manusia Pawon Melalui Gambaran Densitas Tulang Alveolar*	PURBAWIDYA: Jurnal Penelitian Dan Pengembangan Arkeologi		
23	Ahmad, et al.(Ahmad et al. 2017)	2017	Description of dental caries and effects of foods on tooth destruction in skulls of Pawon Man	PURBAWIDYA: Jurnal Penelitian Dan Pengembangan Arkeologi	Clinical examination	Dental caries
24	Salsabila, A.(Salsabila 2018)	2018	*Gambaran Bakteri basil-like di Kalkulus Gigi Manusia Pawon III menggunakan* Scanning Electron Microscope	Undergraduate thesis	Scanning Electron Microscope (SEM)	Dental calculus (Basil-like bacteria)
25	Ersyaputri, A.K.(Ersyaputri 2018)	2018	*Gambaran Bakteri Coccus-like di Kalkulus Gigi Manusia Pawon V menggunakan* Scanning Electron Microscope	Undergraduate thesis	Scanning Electron Microscope (SEM)	Dental calculus (Coccus-like bacteria)
26	Hayat, F.(Hayat 2018)	2018	*Gambaran Inklinasi Gigi Kerangka Manusia Pawon dengan Pencitraan* CBCT 3D	Undergraduate thesis	CBCT 3D Ez Implant 3D Program	Tooth inclination
27	Farhana, N.F.B.A.G.(Farhana 2018)	2018	Age estimation based on pulp chamber volume of first molars of Pawon Man teeth	Undergraduate thesis	CBCT 3D	Age estimation
28	Mohanadas,S. (Mohanadas 2018)	2018	Age estimation using pulp-volume method on canines of pawon man	Undergraduate thesis	CBCT 3D	Age estimation
29	Hasya, A. L.(Hasya 2019)	2019	*Gambaran Unsur Kimia Kalkulus Gigi Manusia Pawon V menggunakan* Scanning Electron	Undergraduate thesis	SEM-EDX	Dental calculus

			Microscopy Energy Dispersive X-Ray Spectroscopy			
30	Fibrio, I.F.(Fibrio 2019)	2019	*Gambaran Unsur Kimia pada Kalkulus Gigi Manusia Pawon IV menggunakan* Scanning Electron Microscopy Energy Dispersive X-Ray Spectroscopy	Undergraduate thesis	SEM-EDX	Dental calculus
31	Dewi, A. K.(Dewi 2019)	2019	*Gambaran Unsur Kimia Kalkulus Gigi Manusia Pawon III menggunakan* Scanning Electron Microscopy Energy Dispersive X-Ray Spectroscopy	Undergraduate thesis	SEM-EDX	Dental calculus
32	Priambada, D.(Priambada 2019)	2019	*Gambaran MAtriks pada Kalkulus Gigi Manusia Pawon IV menggunakan* Scanning Electron Microscope	Undergraduate thesis	SEM	Dental calculus
33	Nurisya, F.(Nurisya 2020)	2020	*Deskripsi Morfometrik Gigi Manusia Pawon R.VI dan R.VII menggunakan* Micro Computer Tomogrpahy	Undergraduate thesis	Micro-CT	Tooth morphometric

The classification of bibliographic data includes the author's name, year of publication, title, reference source, technology used, and variables studied. According to Table 1, all authors are affiliated with institutions in Indonesia, and the research has been conducted within the country. Since 2003, there have been 33 articles related to forensic odontology published in the form of undergraduate theses and journals. Five articles were published between 2012 and 2019.

Table 2. Pawon Man Research Year

Year	Total	Percentage
2012	1	3,03%
2016	21	63,63%
2017	1	3,03%
2018	5	15,15%
2019	4	12,12%
2020	1	3,03%

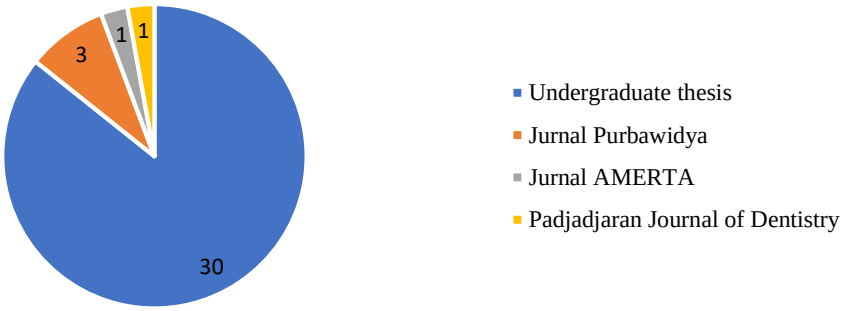


Picture 1. Diagram of Pawon Man Research Year

As illustrated in Table 2, a significant majority, specifically 63.63%, of research on Pawon Man within the field of forensic odontology was conducted in 2016. Notably, since 2020, there has been a notable absence of further research on Pawon Man in this domain.

Table 3. Pawon Man Research Reference Source

References Source	Total	Percentage
Undergraduate thesis	30	90,90%
Jurnal Purbawidya	3	9,09%
Jurnal AMERTA	1	3,03%
Padjadjaran Journal of Dentistry	1	3,03%

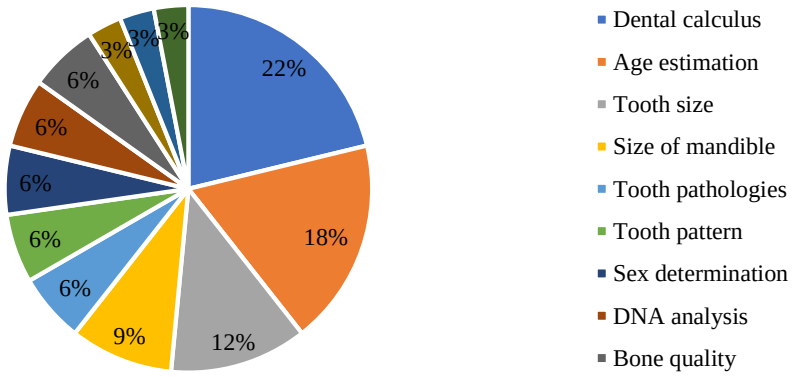


Picture 2. Diagram of Pawon Man Research Reference Source

Table 3 indicates that undergraduate theses constitute the majority of research on Pawon Man within the field of forensic odontology, accounting for 90.90% of the total. The remaining research is presented in the form of journal articles accessible online. Notably, two of these published articles align with the findings of the undergraduate theses and are authored by the same researcher.

Table 4. Variables in Pawon Man Research

No	Variables	Total	Percentage
1	Dental calculus	7	21,21%
2	Age estimation	6	18,18%
3	Tooth size	4	12,12%
4	Size of mandible	3	9,09%
5	Tooth pathologies	2	6,06%
6	Tooth pattern	2	6,06%
7	Sex determination	2	6,06%
8	DNA analysis	2	6,06%
9	Bone quality	2	6,06%
10	Bone quantity	1	3,03%
11	Race	1	3,03%
12	Oral hygiene	1	3,03%

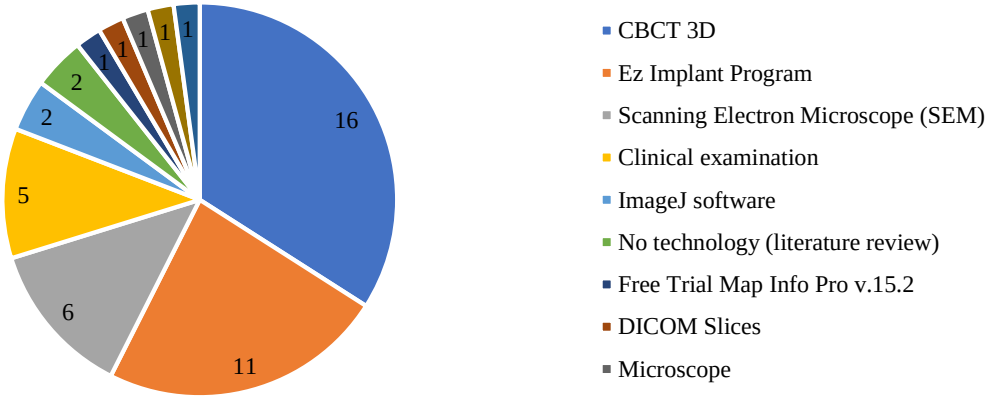


Picture 3. Diagram of Variables in Pawon Man Research

Table 4 presents the classification of variables examined in the Pawon Man researches. The predominant variable, comprising 21.21% of the research, is dental calculus, investigated through clinical or other forms of examination. The second most frequently studied variable is age estimation, which constitutes 18.18% of the research focus.

Table 5. Technology Used in Pawon Man Research

Technology Used	Total	Percentage
CBCT 3D	16	48,48%
Ez Implant Program	11	33,33%
Scanning Electron Microscope (SEM)	6	18,18%
Clinical examination	5	15,15%
ImageJ software	2	6,06%
No technology (literature review)	2	6,06%
Free Trial Map Info Pro v.15.2	1	3,03%
DICOM Slices	1	3,03%
Microscope	1	3,03%
Micro-CT	1	3,03%
Photography	1	3,03%



Picture 4. Diagram of Technology Used in Pawon Man Research

Table 5 categorizes the research on Pawon Man based on the technology. It reveals that 48.48% of the studies utilized 3D Cone Beam Computed Tomography (CBCT) radiography. Additionally, 33.33% of the studies combined 3D CBCT radiography with the Ez Implant program. The remaining 17 studies employed various other technologies.

Discussion

The study of Pawon Man, a notable prehistoric find from Pawon Cave in West Bandung Regency, West Java, has become a pivotal area of research within forensic odontology at the Faculty of Dentistry, Universitas Padjadjaran. This scientific article offers

a detailed review of the evolution of research on Pawon Man, with particular emphasis on the technologies used in the analysis and identification processes.

The discovery of human skeletons at Pawon Cave offers significant insights into the human history of the West Java region. Research conducted on these skeletal remains contributes profoundly to our understanding of human evolution and the historical development of the region. Among the 33 articles reviewed, 16 indicate that the most prevalent technology used is radiographic imaging utilizing 3D Cone Beam Computed Tomography (CBCT). This method is favoured for its efficiency, non-destructive nature, and suitability for both living and deceased subjects (Shahin, Chatra, and Shenai 2013). Radiographic techniques, particularly CBCT, are highly valued in legal contexts for providing objective data that are both detailed and reliable, surpassing the accuracy of subjective written records (Manigandan et al. 2015). CBCT offers a significant advancement over traditional 2D radiography by producing more precise and comprehensive images (Karjodkar 2019; Boedi et al. 2022). Additionally, eleven of the 16 studies employing 3D CBCT also incorporated the Ez Implant Program, which facilitates enhanced data processing and interpretation. The integration of advanced imaging technologies like CBCT not only enriches our understanding of the skeletal remains of Pawon Man but also highlights the importance of interdisciplinary approaches in the fields of anthropology, archaeology, and forensic science. Future research could benefit from exploring the application of emerging imaging technologies and methodologies to further refine our insights into prehistoric human populations and their environments.

Six of the 33 studies utilized Scanning Electron Microscope (SEM) to analyse bacteria and chemical constituents in dental calculus. First introduced in archaeological contexts, SEM offers valuable insights into past human behaviour and health (Dobney and Brothwell 1987). Its benefits include broad applicability, three-dimensional imaging, detailed topography, and low radiation risk, with results typically available in under five minutes after proper sample preparation . However, SEM also presents challenges: it is large, costly, and sensitive to electrical, magnetic, or vibrational interference. Regular maintenance is required to monitor voltage and cooling systems, and effective operation demands specialized training, highlighting the necessity for skilled personnel to fully realize its analytical capabilities (Choudhary et al. 2017). SEM revolutionizes archaeology by revealing hidden details in artifacts and human remains. It analyses chemical composition and microstructure, helping archaeologists understand ancient cultural practices, diets, and environments. For instance, SEM can analyse dental calculus to provide insights into past health and nutrition, enriching archaeological contexts. Additionally, it aids in identifying materials like pigments, shedding light on production and trade techniques. Ultimately, SEM exemplifies the powerful synergy between technology and scientific research.

Seven of 33 studies did not utilize technology, five relied on clinical examinations, and two conducted literature reviews. Clinical examinations systematically evaluate hard and

soft tissues in the oral cavity to distinguish health from disease, involving thorough assessments, meticulous data recording, and analysis that informs coherent diagnoses and treatment strategies (Terezhalmy et al. 2021). Similarly, archaeology employs systematic examination of artifacts and structures to gain insights into past human behaviours and cultures. This process distinguishes functional from decorative elements through site assessments and contextual histories, utilizing stratigraphic excavations, radiocarbon dating, and expert consultations. The integration of technology, like 3D modelling and remote sensing, enhances data collection and analysis, allowing for better visualization and interpretation of findings. Literature reviews, on the other hand, establish a strong foundation for developing new conceptual models and mapping research evolution over time. Tailoring review methods to specific objectives is crucial (Snyder 2019). Beyond summarizing existing research, literature reviews offer fresh perspectives, promote deeper understanding, and identify trends, ultimately guiding future research directions more effectively.

Studies on various aspects of prehistoric human remains have provided deeper insights into their physical characteristics and dental health. Among the 33 reviewed articles, seven focus specifically on dental calculus. Dental calculus serves as a valuable investigative tool in forensic science. However, its most significant applications are found within anthropology, particularly archaeology. Since its initial recognition as a source of information about past human lifestyles, the analysis of ancient calculus has undergone considerable technological advancements. The quality and significance of the data obtained from embedded microfossils and other artifacts are continually improving and expanding (Forshaw 2022). Dental calculus samples indicates that the starch found in the teeth of Pawon Man is minimal, suggesting that this population likely consumed a higher proportion of protein (Khairani 2016). Potential of dental calculus in reconstructing historical dietary conditions, providing insights into dietary changes over time. Further studies indicate that analysing ancient dental calculus can reveal the presence of specific bacteria and the types of food consumed throughout an individual's life (Mattia et al. 2021). These studies imply a historical dietary shift between Pawon Man and contemporary humans. Moreover, mandible of Pawon Man exhibits greater thickness compared to that of modern Sundanese individuals aged 25-35 years (Desrilyana 2016). Pawon Man exhibits the highest bone density in the posterior region of the left side. Such findings suggest that the hardness of consumed food, an environmental factor, significantly influences the development of jaw structure. Nevertheless, further research is required to fully understand the environmental factors influencing jaw development (Fauzan et al. 2019).

Six of the 33 articles focused on age estimation. In forensic investigations, constructing biological profiles is crucial for establishing potential matches and identification. These profiles include demographic information such as sex, age, ancestry,

and stature (Zapico et al. 2021). Age estimation, whether for living or deceased individuals, is a critical forensic parameter that offers valuable insights into an individual's biological profile (Parra, Zapico, and Ubelaker 2020). A comprehensive understanding of age and sex is essential for bioarchaeological analysis, as it provides context for interpreting archaeological findings and assessing past population conditions (Boldsen, Milner, and Ousley 2022). There are discrepancies in estimating age compared to previous studies on Pawon Man. This highlights the necessity for further research to investigate additional factors, including biological and genetic influences, that may impact the accuracy of age estimation outcomes (Farhana 2018).

These studies hold significant implications for the broader field of forensic odontology. The discovery and analysis of the Pawon Man skeleton offer a valuable foundation for advancing identification and analysis techniques withing contemporary forensic context. As technological and analytical methods evolve, it is anticipated that this study will continue to contribute meaningfully to the disciplines of archaeology and anthropology.

Although numerous researches on Pawon Man, comprehensive bibliographic study, such as that presented in this article, has been lacking due to challenges in accessing source materials. Many of these studies are not available online, complicating efforts to compile a complete overview. This bibliographic study offers a structured and expansive summary of research developments in this field, laying a solid foundation for future investigations.

Despite the substantial body of existing research on Pawon Man, several areas require further exploration to deepen our understanding of this significant archaeological find. The precision of age estimation methods needs refinement, the factors behind the absence of dental caries warrant investigation, and advancements in DNA analysis could unlock new genetic insights. Future studies should prioritize interdisciplinary collaboration, particularly between forensic odontology, archaeology, and genetics, to address these gaps. Investigating the genetic makeup of Pawon Man's remains could shed light on population migration and adaptation in prehistoric West Java. Comparative analysis of dental calculus from Pawon Man with other archaeological sites may reveal dietary patterns and health status across different periods. Moreover, exploring the influence of environmental factors on skeletal development and health could illuminate how early human populations adapted to their surroundings. By integrating these approaches, researchers can create a more comprehensive understanding of Pawon Man's life and times, contributing to our knowledge of contemporary human evolution.

SUMMARY

Forensic odontology research concerning Pawon Man at Pawon Cave has made notable strides, particularly with the integration of modern technologies such as 3D Cone Beam Computed Tomography (CBCT). These advancements have enhanced our

understanding of the physical characteristics, dental health, and evolutionary aspects of prehistoric humans in the West Java region. Moving forward, addressing future challenges and seizing new opportunities will necessitate inter-institutional collaboration and the application of additional technologies to gain further insights into Pawon Man. This ongoing study is anticipated to serve as a foundational reference for subsequent studies by incorporating additional factors and methodologies.

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