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The role of biomedical professionals in trichology: therapeutic approaches to the treatment of androgenetic alopecia

A atuação do biomédico na tricologia: abordagens terapêuticas no tratamento da alopecia androgenética

La actuación del profesional de biomedicina en tricología: enfoques terapéuticos en el tratamiento de la alopecia androgenética

Júlia de Araujo Batista[1] – Centro Universitário Instituto de Ensino Superior de Brasília – IESB.
Rachel Catharina de Paula e Silva Caetano[2] – Centro Universitário Instituto de Ensino Superior de Brasília – IESB.

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Abstract

INTRODUCTION: Androgenetic alopecia (AGA) is a chronic, multifactorial hair condition associated with genetic predisposition and androgen activity, potentially affecting self-esteem and quality of life. OBJECTIVE: To critically compare the evidence on microneedling, scalp intradermotherapy/mesotherapy, and platelet-rich plasma (PRP), alone or combined, in AGA management. METHODOLOGY: A descriptive and analytical integrative review, with searches conducted between February and May 2026 in PubMed, SciELO, the Virtual Health Library (BVS), and the CAPES Journals Portal. Articles published from 2020 to 2026 were considered. Of 300 identified records, 10 studies met the inclusion criteria. RESULTS: The most consistent evidence was observed for microneedling combined with minoxidil, improving outcomes such as hair density/count and diameter in some studies. PRP showed positive results for hair density, but with high heterogeneity and methodological limitations. The intradermotherapy literature was less standardized. CONCLUSION: These techniques may be considered complementary resources, but a universally superior protocol cannot be established. More standardized studies with larger samples, prolonged follow-up, and systematic assessment of adverse events are needed. Biomedical practice must follow scientific evidence and applicable technical and legal limits.

Keywords: Androgenetic alopecia; trichology; microneedling; platelet-rich plasma; biomedicine.

Resumo

INTRODUÇÃO: A alopecia androgenética (AGA) é uma condição capilar crônica e multifatorial, associada à predisposição genética e à ação dos andrógenos, podendo afetar a autoestima e a qualidade de vida. OBJETIVO: Comparar criticamente as evidências sobre microagulhamento, intradermoterapia/mesoterapia capilar e plasma rico em plaquetas (PRP), isolados ou combinados, no manejo da AGA. METODOLOGIA: Revisão integrativa, descritiva e analítica, com buscas realizadas entre fevereiro e maio de 2026 nas bases PubMed, SciELO, Biblioteca Virtual em Saúde (BVS) e Portal de Periódicos CAPES. Foram considerados artigos publicados de 2020 a 2026. Dos 300 registros identificados, 10 estudos atenderam aos critérios de inclusão. RESULTADOS: As evidências mais consistentes foram observadas para o microagulhamento associado ao minoxidil, com melhora de desfechos como densidade/contagem e diâmetro dos fios em alguns estudos. Para o PRP, houve resultados positivos para densidade capilar, mas com heterogeneidade elevada e limitações metodológicas.

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

A literatura sobre intradermoterapia apresentou menor padronização. CONCLUSÃO: As técnicas podem ser consideradas recursos complementares, mas não é possível estabelecer um protocolo universalmente superior. São necessários estudos mais padronizados, com amostras maiores, acompanhamento prolongado e avaliação sistemática de eventos adversos. A atuação do biomédico deve seguir as evidências científicas e os limites técnico-legais aplicáveis.

Palavras-chave: Alopecia androgenética; tricologia; microagulhamento; plasma rico em plaquetas; biomedicina.

Resumen

INTRODUCCIÓN: La alopecia androgenética (AGA) es una afección capilar crónica y multifactorial asociada con predisposición genética y acción de los andrógenos, que puede afectar la autoestima y la calidad de vida. OBJETIVO: Comparar críticamente las evidencias sobre microagujas, intradermoterapia/mesoterapia capilar y plasma rico en plaquetas (PRP), aislados o combinados, en el manejo de la AGA. METODOLOGÍA: Revisión integradora, descriptiva y analítica, con búsquedas entre febrero y mayo de 2026 en PubMed, SciELO, Biblioteca Virtual en Salud (BVS) y Portal de Revistas CAPES. Se consideraron artículos publicados entre 2020 y 2026. De 300 registros identificados, 10 estudios cumplieron los criterios de inclusión. RESULTADOS: Las evidencias más consistentes correspondieron a microagujas asociadas con minoxidil, con mejoras de densidad/recuento y diámetro capilar en algunos estudios. El PRP mostró resultados positivos en densidad, pero con elevada heterogeneidad y limitaciones metodológicas. La literatura sobre intradermoterapia presentó menor estandarización. CONCLUSIÓN: Las técnicas pueden considerarse recursos complementarios, pero no es posible establecer un protocolo universalmente superior. Se necesitan estudios más estandarizados, con muestras mayores, seguimiento prolongado y evaluación sistemática de eventos adversos. La actuación del profesional de biomedicina debe seguir las evidencias científicas y los límites técnicos y legales aplicables.

Palabras clave: Alopecia androgenética; tricología; microagujas; plasma rico en plaquetas; biomedicina.

1 Introduction

Androgenetic alopecia (AGA) is a chronic, multifactorial condition associated with genetic predisposition and the action of dihydrotestosterone (DHT) on susceptible follicles. Follicular miniaturization progressively reduces hair density and may affect self-esteem, body image, and quality of life, making the choice of individualized therapeutic strategies relevant (Devjani et al., 2023; Nestor et al., 2021).

Management includes conventional treatments, such as minoxidil and finasteride, and complementary approaches, such as microneedling, scalp intradermotherapy/mesotherapy, and platelet-rich plasma (PRP). These techniques differ in their mechanisms and application methods: microneedling produces controlled microinjuries; mesotherapy delivers substances through microinjections; and PRP uses an autologous platelet concentrate. However, protocols

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

and study quality vary, limiting direct comparisons between interventions (English et al., 2022; Gupta et al., 2023; Tang et al., 2022; Kaiser et al., 2023b).

Some studies report improvements in hair count, density, or diameter, particularly when microneedling is combined with minoxidil. For PRP, findings suggest a possible benefit for density, although not all outcomes show significant differences from control groups. Heterogeneity in samples, protocols, and follow-up periods limits the generalizability of results and assessment of their persistence (Ahmed et al., 2025; Kieling et al., 2024; Pei et al., 2024; Zhang et al., 2023).

In this context, qualified biomedical professionals should prioritize critical interpretation of evidence, individual assessment, planning and monitoring of outcomes, documentation of progress, and attention to adverse events. The indication and performance of procedures must respect professional education, qualifications, and current technical and legal standards, with referral to other professionals when necessary (Kaiser et al., 2023b; Nestor et al., 2021).

Thus, this integrative review aims to critically compare the evidence on microneedling, scalp intradermotherapy/mesotherapy, and PRP, used alone or in combination, considering clinical outcomes, differences between protocols, adverse events, and methodological limitations. It seeks to clarify which results are supported by the available studies and how this analysis can guide safer, evidence-based trichological practice.

2 Methodology

This study is a descriptive and analytical integrative literature review. Searches were conducted between February and May 2026 in PubMed, SciELO, the Virtual Health Library (BVS), and the CAPES Journals Portal. To standardize terminology, descriptors from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) vocabularies were consulted.

Articles published between 2020 and 2026 were considered, using the Portuguese and English terms “alopecia androgenética” (androgenetic alopecia), “microagulhamento” (microneedling), “mesoterapia” (mesotherapy/intradermal injections), and “plasma rico em plaquetas” (platelet-rich plasma). Terms were combined using the Boolean operators AND and OR, with adaptations for each database. The strategies targeted studies on the investigated therapies and their application in trichology.

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

Original articles, systematic reviews, and meta-analyses addressing AGA treatment with microneedling, intradermotherapy/mesotherapy, PRP, or combined therapies were included. Studies on clinical application, protocol planning, biosafety, and monitoring were also considered, provided that full texts were available and they were published within the defined period.

Articles without full texts, studies not directly related to the objective, papers focused exclusively on general dermatology or conditions without an emphasis on hair therapies, and publications on commercial cosmetics or isolated oral treatments without trichological intervention were excluded.

Following selection, data were organized in a spreadsheet for comparative analysis, covering study design, population, intervention, clinical outcomes, adverse events, and methodological limitations. Other references were used to contextualize the topic and support critical interpretation of the findings, without being counted among the studies selected for the table. The synthesis considered reported efficacy, consistency of the evidence, and the relevance of biomedical professionals in planning and monitoring protocols.

3 Results

The structured search in the selected databases initially identified 300 records related to androgenetic alopecia and trichological therapies. After eligibility criteria were applied, selection proceeded in stages: screening titles, abstracts, and full texts.

During title screening, 100 records were excluded because they were not directly related to the objective, leaving 200 for abstract screening. At this stage, 100 were excluded because they did not address the investigated interventions or provided insufficient information for analysis.

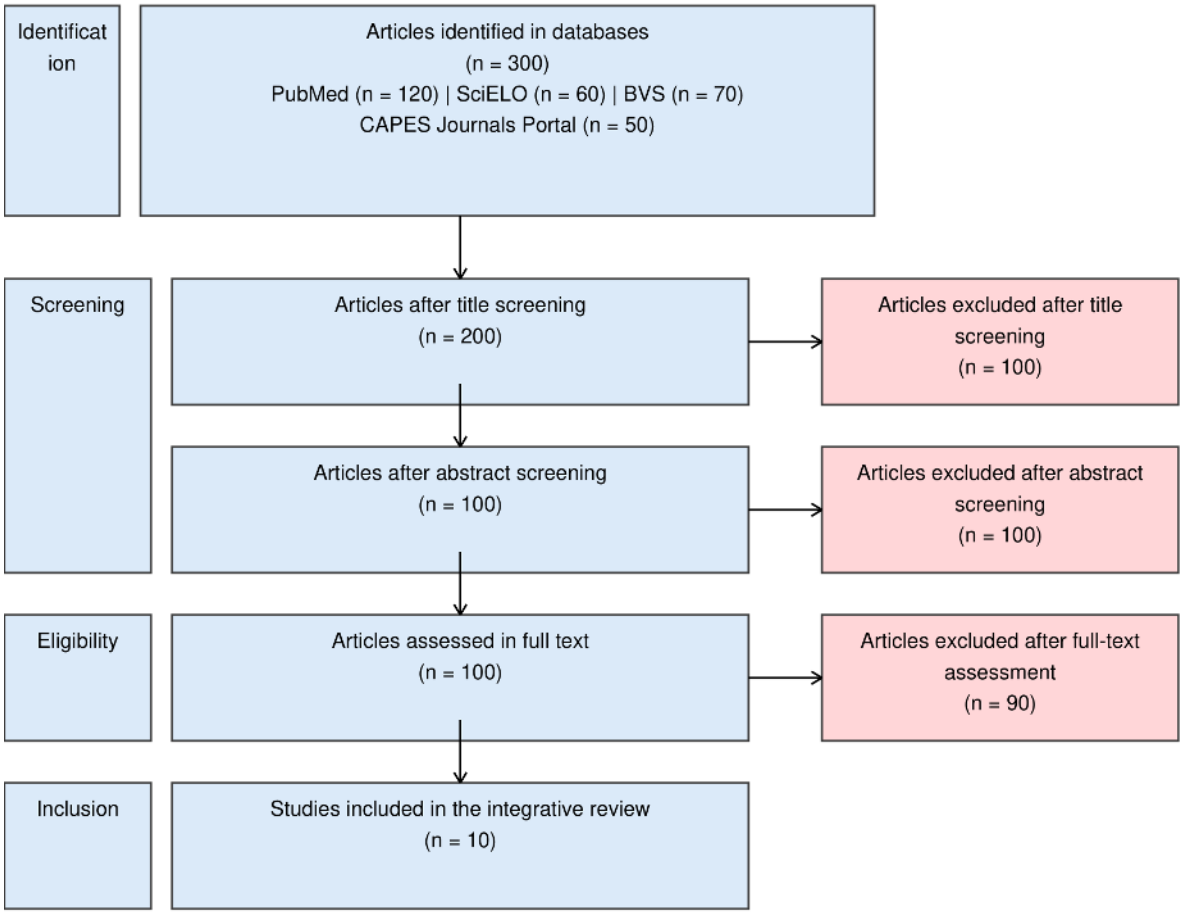
The remaining 100 full texts were assessed in full; 90 were excluded because they did not meet the objectives, had methodological limitations, or lacked clinical data relevant to AGA.

Thus, ten studies formed the comparative synthesis of this integrative review. Their characteristics, interventions, results, and limitations are organized in Table 1.

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

Figure 1 – Flowchart of study selection stages for the integrative review



Source: the author (2026).

Table 1 – Characteristics of studies included in the integrative review, 2026.

Author/ year	**Title/topic**	**Objective**	**Method/sample**	**Main results and limitations**
Ahmed et al. (2025)	Microneedling combined with topical minoxidil	Compare the combination with minoxidil alone in AGA treatment.	Systematic review and meta-analysis; 12 randomized clinical trials, 631 participants.	The combination improved hair count (SMD = 1.32; 95% CI 0.73–1.92) and diameter in six studies (SMD = 0.34; 95% CI 0.11–0.58). High heterogeneity for count (I^2 = 88%); more adverse events, generally mild or self-limiting.
Kieling et al. (2024)	Autologous PRP and hair density	Assess PRP efficacy compared with placebo in AGA.	Systematic review and meta-analysis; 14 studies, 431 participants.	Estimated mean increase of 27.55 hairs/cm² (95% CI 14.04–41.06), but very high heterogeneity (I^2 = 95.99%), low-quality evidence, and publication bias; diameter showed no significant difference.

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

Author/ year	Title/topic	Objective	Method/sample	Main results and limitations
Pei et al. (2024)	Combined microneedling	Compare efficacy and safety of combinations with treatments alone.	Systematic review and meta-analysis; 13 randomized trials, 696 participants.	Combinations favored hair density and diameter. The difference in adverse event incidence was not significant; patient satisfaction also did not differ significantly.
Gupta et al. (2023)	Mesotherapy for hair loss	Summarize outcomes and safety of agents administered by microinjections.	Systematic review; 27 publications on different agents and combinations.	Some studies reported improved growth, but standardized regimens are lacking and adverse effects were described; the authors recommend larger controlled trials.
Kaiser et al. (2023a)	Combined therapies with PRP	Examine evidence on combinations of PRP with other interventions.	Systematic review; three randomized trials compared PRP combined with minoxidil against control alternatives.	Two trials reported greater hair growth after five or six months. Few trials, small samples, and differences in PRP preparation protocols limit conclusions.
Zhang et al. (2023)	PRP for androgenetic alopecia	Assess hair density, count, and diameter after PRP.	Systematic review and meta-analysis; nine randomized trials, 238 participants.	Density increased at three and six months versus placebo; count and diameter did not differ significantly. Two of seven studies reported adverse reactions, without serious events described.
English et al. (2022)	Microneedling in hair loss disorders	Summarize clinical evidence on microneedling in different conditions.	Systematic review; 22 studies, 1,127 participants; 17 AGA investigations, 911 participants.	Improvements were reported in several adjunctive protocols, but devices, depths, and frequencies were heterogeneous. Evidence quality was limited; no serious events were reported among 657 treated participants.
Tang et al. (2022)	Mesotherapy in pattern hair loss	Assess efficacy and limitations of mesotherapy in pattern hair loss.	Systematic review; 12 studies with different designs.	Some studies reported favorable results, but the authors highlighted limited samples, insufficient comparisons with other treatments, and the need for more evidence.
Faghihi et al. (2021)	Microneedling at two depths	Compare 0.6-mm and 1.2-mm microneedling combined with minoxidil.	Clinical study involving 60 participants; 12 weeks of follow-up.	The 0.6-mm combination improved count and thickness compared with minoxidil alone. Small sample and short follow-up limit generalizability.
Gentile and Garcovich (2020)	PRP in androgenetic alopecia	Review clinical evidence on PRP compared with other therapies.	Systematic review; 12 clinical trials analyzed.	84% of studies reported some positive effect, but only some showed statistically significant improvements in objective measures. Differences in preparation and application hinder comparisons.

Source: prepared by the author (2026).

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

4 Discussion

The ten studies summarized in Table 1 address microneedling, PRP, and mesotherapy, including isolated interventions and therapeutic combinations. Study designs, comparators, outcomes, and follow-up periods are not uniform; therefore, these techniques should not be considered equivalent or compared solely on the basis of positive results. Interpretation should consider effect magnitude, statistical significance, methodological quality, and adverse events.

For microneedling combined with topical minoxidil, Ahmed et al. (2025) pooled 12 randomized clinical trials involving 631 participants. Compared with minoxidil alone, the combination improved hair count (SMD = 1.32; 95% CI 0.73–1.92) and, in six studies, hair diameter (SMD = 0.34; 95% CI 0.11–0.58). However, heterogeneity for hair count was high (I^2 = 88%), indicating substantial variation in results. More adverse events were also recorded in the combined group (74 versus 59), although generally mild or self-limiting. Thus, the results favor the combination for some outcomes, but must be weighed against variability and tolerability.

In the trial by Faghihi et al. (2021), 60 participants with moderate or severe androgenetic alopecia were followed for 12 weeks. Combining minoxidil with 0.6-mm microneedling increased hair count and thickness more than minoxidil alone; the 1.2-mm protocol also showed improvement in clinical assessment. Despite this comparative result, the small sample and short follow-up do not establish that the same depth is ideal for all patients or that the effects persist over the long term.

The systematic review by English et al. (2022) included 22 clinical studies involving 1,127 participants with different hair loss disorders; 17 investigations, involving 911 participants, assessed androgenetic alopecia. The authors identified improvements in hair parameters with several adjunctive protocols, including combinations with minoxidil and/or PRP. However, devices, application depths, and session frequencies were heterogeneous, and the overall quality of evidence was considered limited. No serious adverse events were reported among 657 participants who received microneedling, but this does not eliminate the need for monitoring and studies with longer follow-up.

For PRP, Zhang et al. (2023), in a meta-analysis of nine randomized clinical trials and 238 participants, observed a significant increase in hair density at three and six months compared with placebo. However, hair count and diameter did not differ significantly from placebo, and two of the seven studies reporting adverse events described reactions without

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

serious events being recorded. Kieling et al. (2024), synthesizing 14 studies involving 431 participants, estimated a mean density increase of 27.55 hairs/cm² (95% CI 14.04–41.06). Heterogeneity was very high (I^2 = 95.99%), evidence quality was low, and there were indications of publication bias; the estimate for diameter showed no statistically significant difference. Evans et al. (2022) also analyzed PRP, reinforcing that results must be interpreted according to each study's outcomes and protocols. Taken together, the data suggest a possible benefit for density, but do not support a uniform conclusion for all parameters.

Gentile and Garcovich (2020) identified positive results in some PRP trials but observed differences in concentrate preparation, comparators, and assessment criteria. In the review by Kaiser et al. (2023a), focused on combined PRP therapies, two of the three randomized trials comparing PRP plus minoxidil with control alternatives reported greater hair growth after five or six months. The authors themselves emphasized the small number of randomized trials, small samples, and protocol diversity. Therefore, the combination is promising but does not yet establish overall superiority or define ideal concentration, frequency, and application intervals. General treatment recommendations also emphasize that selection should balance evidence, risks, preferences, and individual characteristics (Kaiser et al., 2023b; Nestor et al., 2021).

Regarding scalp intradermotherapy/mesotherapy, Gupta et al. (2023) analyzed 27 publications on different agents and combinations. Although some studies reported improved hair growth, the authors identified a lack of standardized therapeutic regimens and adverse effects, recommending larger controlled trials. Tang et al. (2022), in a systematic review of pattern hair loss, also reported favorable results in some studies but highlighted limited samples and insufficient comparisons with other therapies. Thus, the evidence for mesotherapy is heterogeneous and does not support a robust comparative conclusion applicable to all AGA protocols.

Joint interpretation requires consideration of safety and clinical applicability. Studies vary in reporting pruritus, erythema, and other adverse events, as well as in recording contraindications; a lack of reports should not be interpreted as a lack of risk. Small samples and short follow-up make it difficult to identify less frequent events and assess persistence of results. Before any procedure, individual assessment and analysis of scalp conditions, current medications, and possible contraindications are necessary, together with transparent guidance on expected benefits, risks, alternatives, and uncertainties (Gupta et al., 2023; Nestor et al., 2021).

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

In this context, the contribution of biomedical professionals qualified in trichology extends beyond performing procedures. It involves critically interpreting evidence quality, selecting approaches appropriate to each case, documenting progress through standardized records, monitoring outcomes, and recognizing adverse events or situations requiring referral. Procedures should be indicated and performed only when consistent with education, qualifications, and current technical and legal standards. This evidence-based practice supports safer decisions and prevents preliminary findings from becoming promises of efficacy (Kaiser et al., 2023b; Nestor et al., 2021).

In summary, microneedling shows more favorable results primarily when combined with minoxidil, improving hair count and, in some analyses, hair diameter; however, protocols and results vary substantially, and adverse events must be considered. PRP provides evidence of possible improvement in hair density, but findings for hair count and diameter are not uniform. Mesotherapy shows promising results in some studies, but a lack of standardization and controlled trials limits assessment of its efficacy. Therefore, evidence consistency is uneven and does not yet establish a universally superior technique.

5 Final considerations

This integrative review aimed to critically compare the evidence on microneedling, scalp intradermotherapy/mesotherapy, and platelet-rich plasma (PRP), used alone or in combination, in the management of androgenetic alopecia. The analysis identified favorable evidence of unequal strength for the approaches examined.

For PRP, the results suggest a possible increase in density, but not all outcomes improved compared with controls, and some analyses indicated low evidence quality and publication bias. For mesotherapy, the lack of standardization and robust comparisons prevents confident establishment of its relative efficacy in AGA treatment.

Differences in protocols, samples, comparators, assessment criteria, and follow-up periods prevent identification of a universally superior technique. Clinical trials with larger samples, standardized descriptions of protocols, prolonged follow-up, and systematic recording of adverse events, contraindications, and persistence of results are needed.

A limitation of this review is that searches were conducted in four information sources (PubMed, SciELO, the Virtual Health Library, and the CAPES Journals Portal), between February and May 2026, considering publications from 2020 to 2026 and available full texts.

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

These restrictions may have limited retrieval of relevant studies not indexed in these sources, published outside the established period, or without full-text access.

Qualified biomedical professionals should combine individualized assessment, critical interpretation of evidence, documented monitoring of therapeutic response, and identification of risks, always within applicable technical and legal limits. In this way, professionals can contribute to safer, more transparent, evidence-based trichological practice while acknowledging the uncertainties that persist in the literature.

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Ano VII, v.1 2026 | submissão: 08/11/2026 | aceito: 15/11/2026 | publicação: 20/11/2026

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