





ORIGINAL ARTICLE

Directions of hyaluronic acid application in cosmetology

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Abstract

Background: Hyaluronic acid is a naturally occurring substance in the human body. It is a component of the intercellular matrix of the dermis and is often used as a raw material in cosmetology. This substance was isolated for the first time in the first half of the twentieth century, while cosmetology treatments and aesthetic medicine have been developing rapidly and gaining popularity. The same applies to companies producing cosmetic care products which contain hyaluronic acid. This is related to the growing desire of the society to improve the quality of the skin and maintain its vitality and firmness.

Aims: The study investigates different directions and possibilities of using hyaluronic acid in cosmetology. Moreover, the paper describes possible side effects observed after hyaluronic acid injections.

Patients/Methods: The study was based on an anonymous questionnaire conducted between October 10, 2021, and February 21, 2022. 513 responses were collected.

Results: The awareness and level of knowledge in this field of cosmetology among potential beauty salon clients are on the rise. Hyaluronic acid is used in injections, as well as in care cosmetics, oral and vaginal preparations. Various areas of the face are injected, most often the lips. Face creams are among the most frequently purchased skincare products.

Conclusions: The use of hyaluronic acid in cosmetology is multidirectional. It is mainly focused on skincare and specific anti-aging activities. Treatments of this type help preserve the skin's vitality, which translates into an improved quality of life due to the satisfaction of the need for attractiveness.

KEYWORDS

aesthetic medicine, cosmetology, face care, hyaluronic acid

1 | INTRODUCTION

Technological development, as well as the wide availability and possibilities of modern cosmetology and aesthetic medicine are behind the increased interest in all kinds of treatments, especially

those which entail the use of hyaluronic acid (HA). Taking care of yourself and your skin is becoming increasingly more important in everyday life. Over the centuries, there have been many different ideals of beauty. As these changed, so did the methods and means that made it possible to approach particular canons. Today, the mass

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media, creating idealized silhouettes, faces, and characters, as well as general social pressure, have caused an even greater interest in cosmetology and aesthetic medicine treatments.¹

Concentration on your appearance is conditioned by constant dependence on the opinions and the approval of other people. Image requirements imposed by, among others, social media, are fueled by cosmetology, pharmaceutical and medical concerns. The most common treatments are those less invasive, such as correction of mimic wrinkles, filling furrows, face modeling, or lip augmentation with the use of HA. Such treatments deliver instantaneous effects with no hospitalization required.¹ However, all these assurances are valid only when the procedure is precisely performed by an experienced and trained specialist.

The desire to reach for rejuvenating treatments is also caused by factors that affect the aging of the skin, often premature. Stimulants play an important role here, including cigarettes and stress, UV radiation, hormonal disorders, improper nutrition, as well as inappropriate and poorly selected skin care.² To skillfully select the right treatments or cosmetic preparations for a given skin condition, knowledge about specific active ingredients including HA is required. Low molecular weight HA may be of greatest importance in reducing wrinkles (especially mimic wrinkles), which results from a greater ability to penetrate deeper layers of the epidermis. In turn, its higher molecular weight plays an important role in terms of the formation of a hydrolipid film—occlusion, on the skin surface.³ For treatments which use HA, cross-linking or chemical modifications of injection gels containing HA is an important issue. This action aims to ensure the durability of the expected effect.⁴ The cosmetologist/aesthetic medicine doctor performing a procedure should discuss various HA options, facial skin anatomy, side effects, and applications thereof in cosmetology. People educated in a given field are responsible for increasing the awareness of their clients/patients. Such activities translate directly into better effects and increased willingness to use appropriate treatments and cosmetic preparations.

The aim of the study was to describe selected cosmetology treatments which use HA, as well as to determine the level of knowledge about HA demonstrated by customers of beauty salons. The study covered knowledge about injectable as well as topical treatments based on HA. Information on the various possibilities of using HA as well as a description of its possible side effects was also presented.

2 | MATERIALS AND METHODS

2.1 | Study design

An anonymous survey comprising 18 questions concerning issues related to the use of HA in cosmetology procedures, and in-home care was conducted. In addition, the survey collected responses regarding the possible side effects and the overall effect of the acid on the skin. The survey consisted of 14 single-choice questions and

4 multiple-choice questions. Volunteers irrespective of gender, age, status, profession, and income took part in the study. The survey was developed on Google Forms. The Institutional Review Board approved this web-based survey. Team members tested the quality and technical functionality of the questionnaire. The survey was conducted between October 7, 2021, and February 21, 2022. 513 responses were collected, all correctly completed.

2.2 | Statistical analysis

The results of the survey were analyzed in Statistica 13.3 (TOBCO Software Inc.) using the Pearson chi-square test. Chi-square ratio values of $p < 0.05$ were agreed as statistically significant. Data were statistically analyzed if a specific answer to a question was selected at least 11 ($n > 10$) times. If the number of responses was lower than the presented threshold, those answers were not included in the statistical analysis. All of the study results were also presented in the form of descriptive statistical analyses.

3 | RESULTS

3.1 | Characteristic of the study group

The demographic characteristics of the respondents are presented in [Table 1](#).

3.2 | Hyaluronic acid survey

The next part of the survey was designed to evaluate the preferences for and the level of knowledge about HA treatments among potential beauty salon clients. The survey was divided into two parts: HA fillers ([Figures 1–8](#)) and topical HA preparations ([Figures 9–14](#)).

3.2.1 | HA fillers

In the “*Before buying and performing a cosmetology treatment by a cosmetologist, do you ask about the properties and effects of the treatment?*” question, 87.13% of the respondents answered “Yes” ([Figure 1](#)). During statistical analysis, gender data showed that both women and men most often chose the affirmative answer ($p = 0.00000$). Moreover, the answer “Yes” was most common regardless of income level ($p = 0.04648$).

In the next “*Have you used any cosmetology services with hyaluronic acid before?*” question, “Yes” was selected by 31.97% of the respondents ([Figure 2](#)). It was found that women used HA services more often ($p = 0.00069$). Moreover, people under 25 most often marked “No” ($p = 0.00446$). It has also been shown that people earning in the two lowest tiers ([Table 1](#)) most often answered “No” ($p = 0.00012$).

		(%)
Gender	Female	89.7%
	Male	10.3%
Age	<25	67.1%
	25–35	16.2%
	35–45	9.2%
	>45	7.6%
Domicile	Village	25%
	Town with up to 25.000 residents	16.6%
	Town with up to 50.000 residents	8.8%
	Town with up-to 100.000 residents	9.4%
	City >100.000 residents	40.4%
Average monthly net income (PLN/EUR)	<2000 PLN (~425 EUR [†])	33.3%
	2000–3000 PLN (~426–638 EUR [†])	26.1%
	3000–4000 PLN (~639–851 EUR [†])	19.1%
	4000–5000 PLN (~852–1063 EUR [†])	10.3%
	>5000 PLN (~1064 EUR [†])	11.1%

[†]At the exchange rate 1 EUR/4.70 PLN (August 2022).

TABLE 1 Study group characteristics

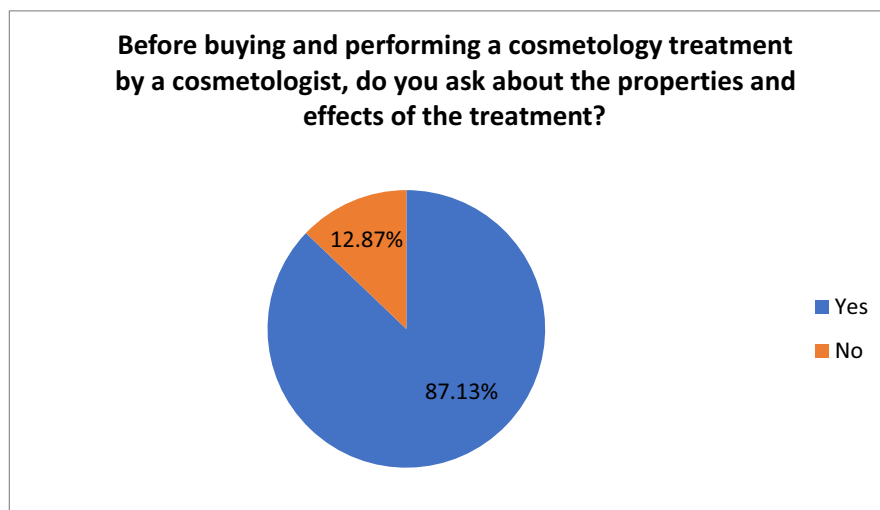


FIGURE 1 Treatment effect enquiries

In the question about post-treatment effects, 34.18% of respondents noticed “skin hydration” (Figure 3). “Firming and tightening of the skin” was the second most frequently indicated response (27.97%). The next answers were “skin smoothing” (22.32%), “filling wrinkles” (12.99%), and “other,” where with lip augmentation (2.54%) was indicated most frequently.

In the “What part of the face does the selected treatment apply to?” question, the most frequent answer was the “lips” (37.39%) (Figure 4). This was followed by the “forehead” (23.95%), the “cheeks” (22.27%), and the “nasolabial fold” (11.34%). 2.94% of responders chose “other” while the “chin” and the “nose” obtained 1.26% and 0.84%, respectively. In the “other” category, respondents mentioned the whole face, lower jaw, chin, mouth corners, and the valley of tears.

Respondents most frequently chose “Yes” to the “Did you have any knowledge of hyaluronic acid before the cosmetic procedure?” question (Figure 5). Statistical analysis showed that regardless of monthly

earnings, respondents look for information about HA before a cosmetic procedure ($p = 0.02969$).

Responses to the “How do you assess the degree of hyaluronic acid interference in the skin?” question were as follows: “average” (62.57%), “high” (30.41%), and “low” (7.02%) (Figure 6). It was also shown that respondents under 25 most frequently indicated “average” ($p = 0.00403$). A similar correlation was shown for earnings, with the two lowest tiers of respondents most likely to indicate “average” ($p = 0.02770$).

9.15% of respondents answered “Yes” to the “Have you experienced any side effects after the hyaluronic acid treatment?” question (Figure 7). Women ($p = 0.03627$) were most likely to provide an affirmative answer. The most common side effects were “edema” (47.06%), “bluish discolouration of the skin” (17.65%), and “other” (17.65%), where the respondents additionally indicated pain, acid clumping in the mouth, and papules (Figure 8).

FIGURE 2 Hyaluronic acid services

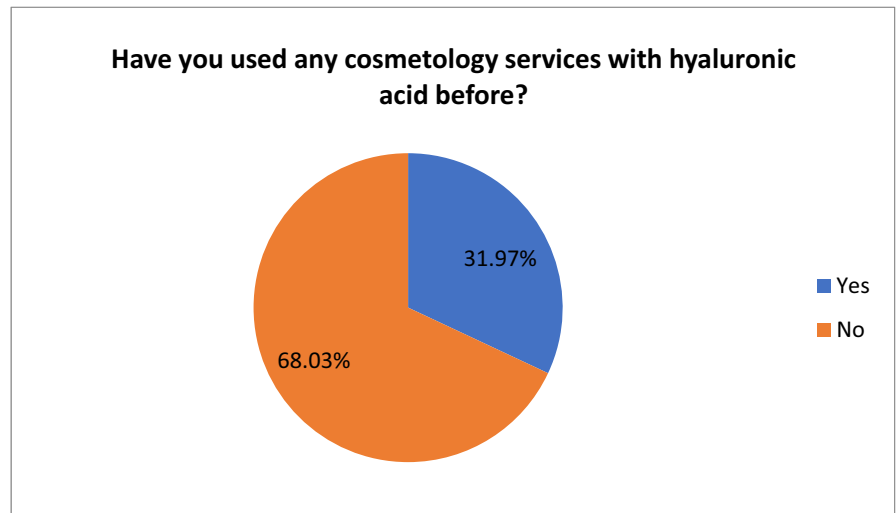


FIGURE 3 Observed effects after HA application

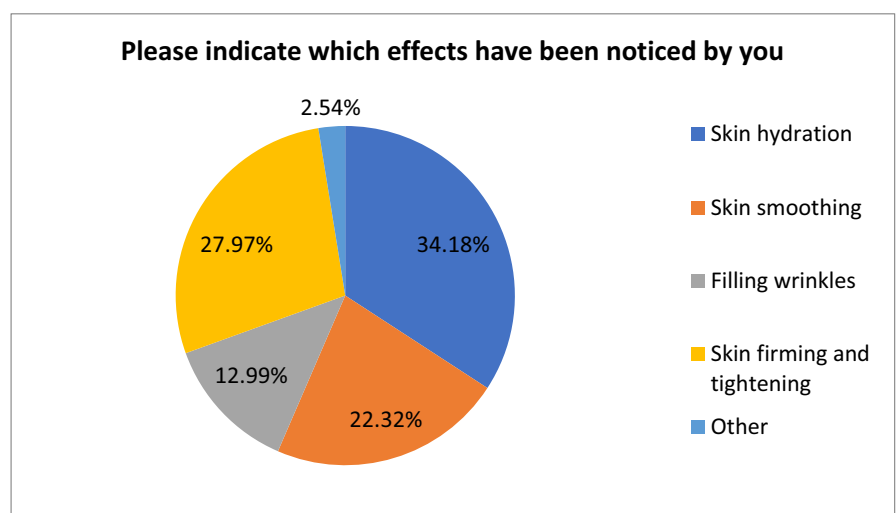
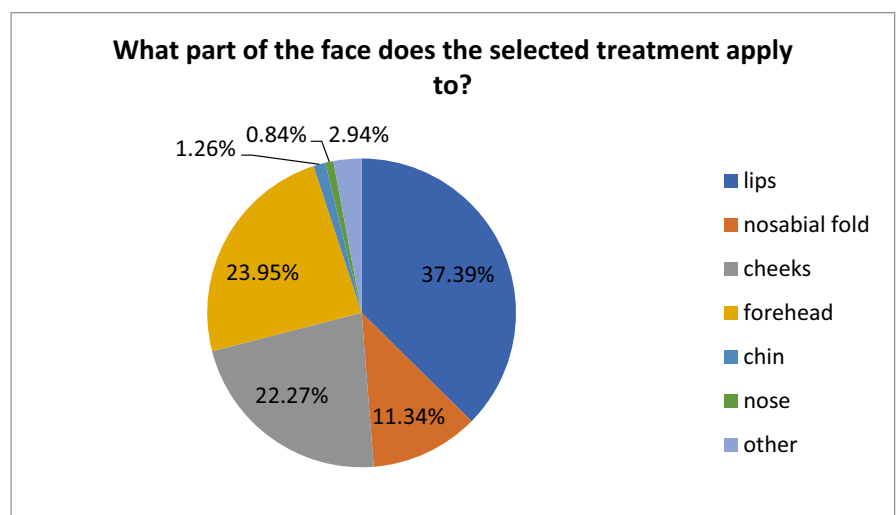


FIGURE 4 Directions of HA application



"In addition to performing treatments with hyaluronic acid, do you use external preparations containing this ingredient?". 62.77% of respondents answered affirmatively (Figure 9) to this question. A statistical analysis showed that external preparations containing HA are used more often by women ($p = 0.00000$).

3.2.2 | Topical HA preparations

Preparations most frequently indicated by respondents were "face cream" and "face serum" with (34.86%) and (31.81%), respectively (Figure 10). The next most frequently chosen answer (18.72%) was

Did you have any knowledge of hyaluronic acid before the procedure?

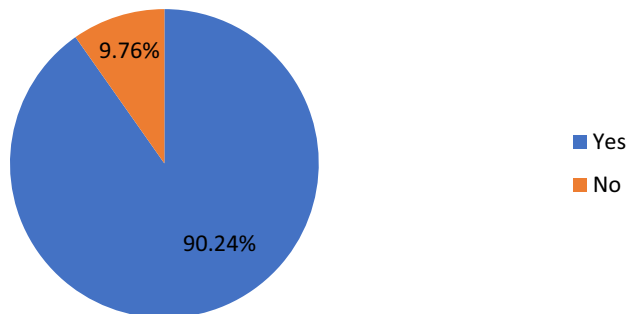


FIGURE 5 Level of respondents' knowledge

How do you assess the degree of hyaluronic acid interference in the skin?

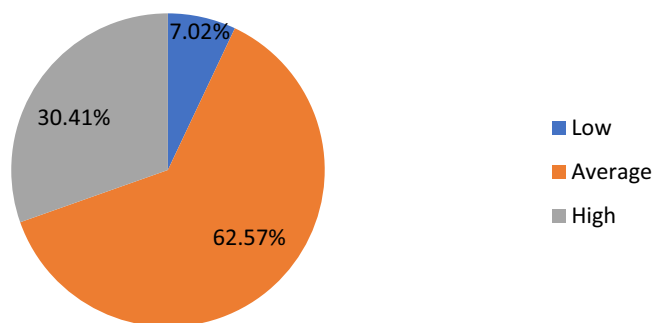


FIGURE 6 Level of HA skin interference

“face mask.” 13.24% of respondents declared using “eye cream” and 0.46% “tonic.” In the “other” answers (0.91%), the respondents indicated hair mask, lip gloss, essence, peeling, facial emulsion, drinking collagen, acid preparations, and intimate hygiene lotion.

In the next question, “*What motivates you to purchase such a product?*”, the most frequent response was “own choice” (61.49%). In turn, 15.84% indicated “promotion in social media,” 11.8% “recommended by a friend,” 5.59% “recommended by a drugstore consultant” and 3.11% “advertising” (Figure 11). 2.17% of the respondents indicated “other” and proposed a beautician/cosmetologist's suggestion, the family's suggestion, and the simultaneous influence of all the abovementioned answers. It was also shown that it is women who are most likely to make purchases based on their own choice ($p = 0.00000$). Purchases on their own are being made mostly by women ($p = 0.00000$), people under 25 ($p = 0.00131$) and people with the lowest income ($p = 0.04895$).

In relation to the previous question, respondents were asked “*Were the promises of the manufacturer of the given cosmetic fulfilled?*”. 50.31% of respondents chose “Yes” while 12.42% chose “No” (Figure 12). It was also shown that people who previously used cosmetology services which entailed HA noticed compliance of the

manufacturer's promise with the obtained effect when using a specific external preparation on the skin ($p = 0.02491$).

57.89% of the respondents answered in the affirmative to the “*Do you think that preparations used externally are able to penetrate deep into the skin?*” question (Figure 13). It was shown that people with the lowest earnings (the two lowest tiers) also answered this question in the affirmative ($p = 0.04313$).

Most respondents (73.88%) in the last question “*Is regular use of anti-wrinkle preparations with hyaluronic acid able to replace cosmetology treatment with hyaluronic acid?*” answered “No” while 26.12% answered affirmatively (Figure 14).

4 | DISCUSSION

Dermal fillers have become one of the most frequently used products to improve the appearance of the skin. Their growing importance in recent years reflects the growing demand for new products on the market. According to the American Academy of Plastic and Aesthetic Surgeons, 2.9 million females worldwide received injections with soft tissue fillers in 2020.⁵ The distinguishing features of

FIGURE 7 Frequency of HA side effects

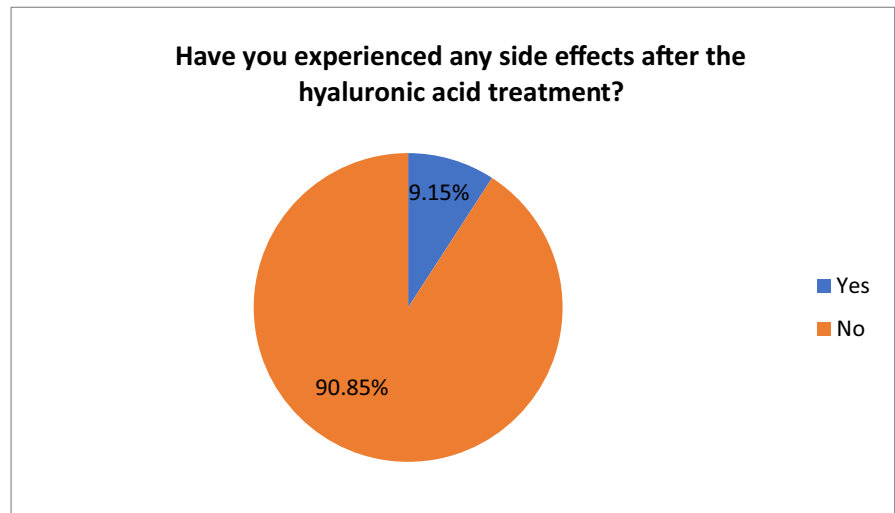
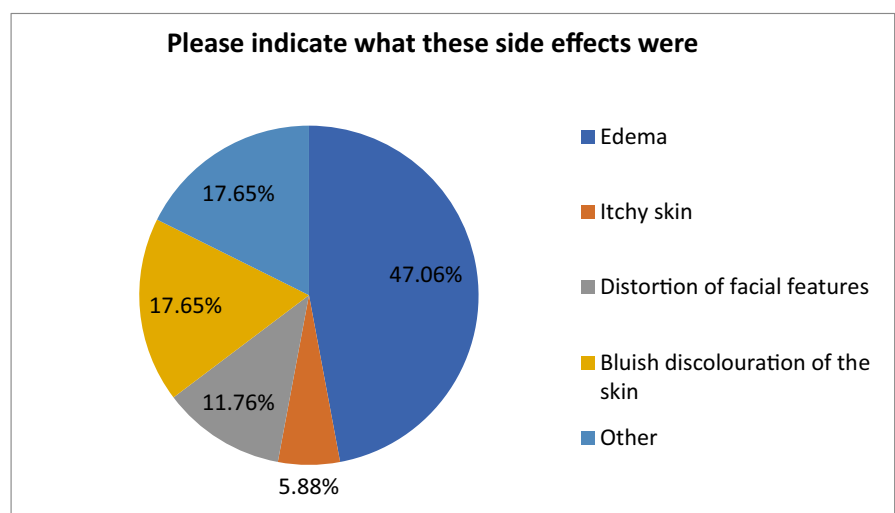


FIGURE 8 Types of HA side effects



HA fillers are particle size, type of cross-linking agent used, degree and percentage of HA cross-linking, and amount of free (unmodified) HA present. All these physical and chemical characteristics influence the clinical characteristics of the filler, such as clinical indication, ease of injection, degree of tissue filling, longevity, clinical appearance, and side effects.⁶

The obtained results indicate that 87.13% of the respondents ask a cosmetologist about the properties and effects of treatment before a procedure (Figure 1). Additionally, about 90% of the respondents declare that before performing a treatment with HA, they had inquired about it (Figure 5). This is a sign that education and knowledge are important for the majority of clients of beauty salons, and what is more, they themselves show initiative to expand it. It should be emphasized that this is a very beneficial effect, as it allows cosmetologists not only to make customers aware but also to build self-confidence on scientific foundations. These foundations include extensive knowledge and certainty as to the treatments performed, and the products used.⁷

Every third person (Figure 2) declared the use of treatments entailing HA. It should be stated that a significant proportion of the respondents are people under 25. According to a recent report,⁸ the process of HA reduction in the human body begins only after the age

of 25. After the age of 40, its level decreases by 50% compared to its amount at the age of 20. Around the age of 80, HA is completely lost, resulting in a reduction in overall density and the volume of the extracellular matrix. The skin becomes rough, dull, and less nourished, and wrinkles appear on its surface.⁸

Among the respondents using HA treatments, there was a similar division when it came to whether the expected effects of the treatment were met (Figure 3). Most people achieved the effect of skin hydration, as well as its firming and tension. The smoothing of the skin and of wrinkles were of no less importance. Similar results were obtained in a study from 2020.⁹ Such results clearly confirm the theoretical records of HA characteristics.^{8,10}

The respondents most often declared undergoing procedures with the use of HA in the area of the mouth (37.39%) (Figure 4). This may be due to the already mentioned desire to pursue a beauty ideal.^{1,11} The excessive number of ads for modeled lips raises an internal need to catch up with such patterns. "Before and after" photographs often published for lip augmentation procedures arouse the greatest interest. Such views cause the formation of complexes, as well as an increasing sympathy for treatments that may change this perception of oneself. The next most frequently indicated areas were the forehead (23.95%), the cheeks (22.27%), and the nasolabial

In addition to performing treatments with hyaluronic acid, do you use external preparations containing this ingredient?

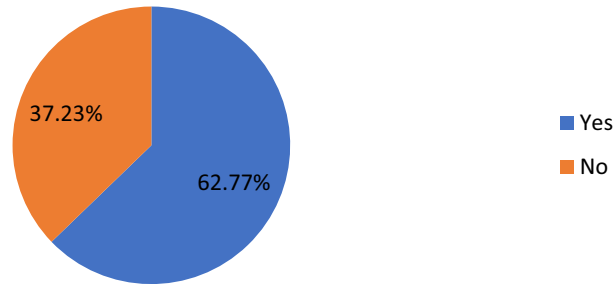


FIGURE 9 Preparations containing HA

Indicate which external preparations you use

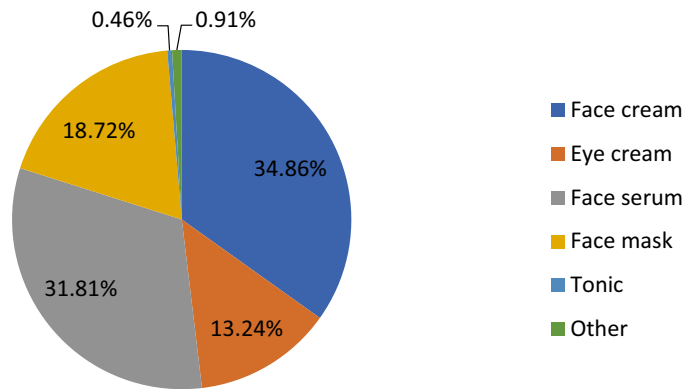


FIGURE 10 External HA preparation use

What motivates you to purchase such a product?

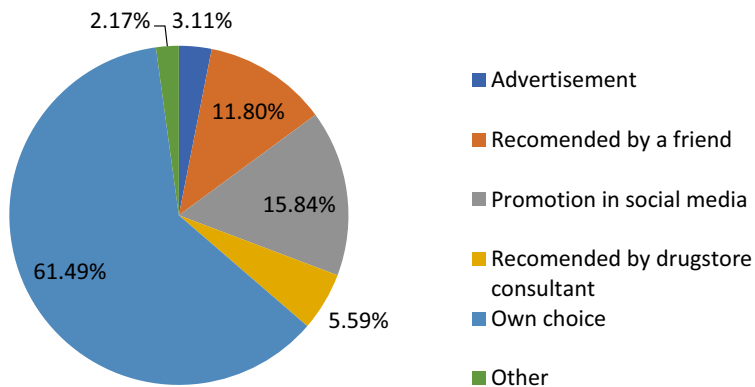


FIGURE 11 Reasons for purchasing HA products

folds (11.35%). These responses were indicated by people who began to notice aging features in these areas (these are the areas most prone to the formation of wrinkles, including mimic wrinkles). The procedure most often performed in the mentioned areas is volumetry.¹² The least interest was shown in the "other" option (2.94%,

including the jaw, the whole face), chin (1.26%), and nose (0.84%). These areas are where botulinum toxin is more often used.¹²

In the case of the degree of HA interference with the skin, more than half of the respondents (62.57%) marked it as average, while 30.41% considered it high (Figure 6). In this case, the

FIGURE 12 Opinion about HA product manufactures

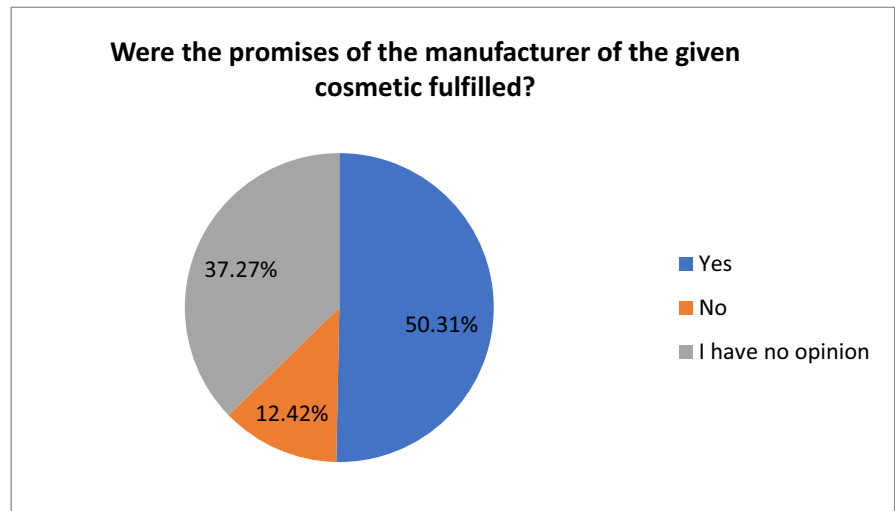


FIGURE 13 Skin penetration of HA products

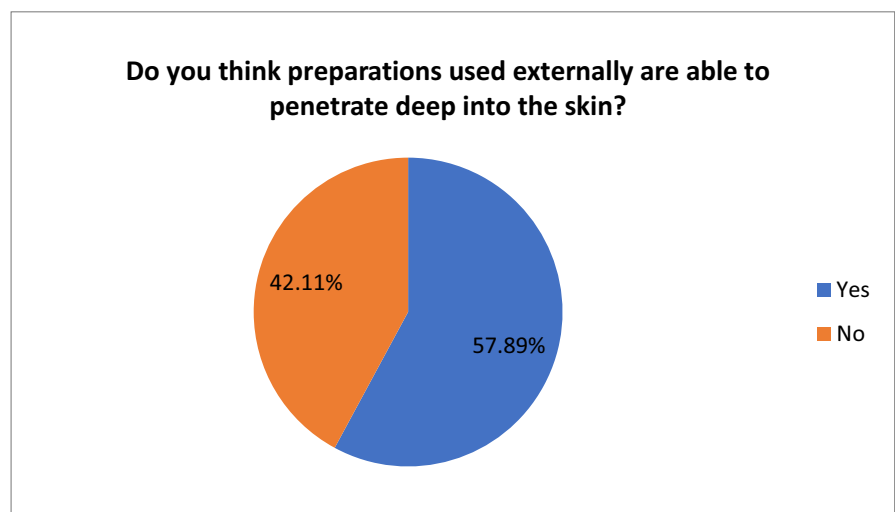
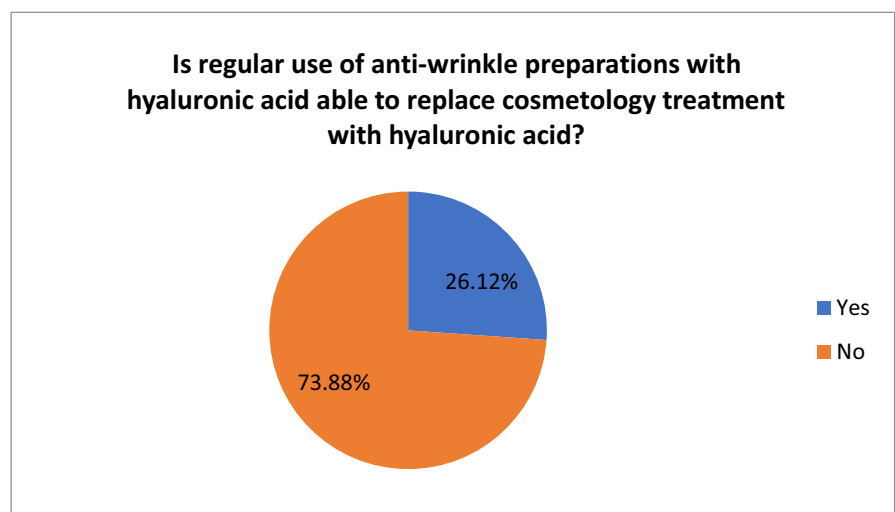


FIGURE 14 Use of anti-wrinkle preparations



degree of interference is determined by the molecular structure of HA, as well as the method of its application. The latest research¹³ has proven that the greatest improvement in the condition and quality of the skin is achieved through HA intradermotherapy. Subsequently, oral therapy is mentioned, and finally, external application of care products.¹³ Only oral supplementation has the

effect of increasing the level of HA in the blood plasma. However, this has no bearing on the labeling of this substance as a disease marker.¹³ About 1/10 of respondents reported side effects after injection with HA (Figure 7). In the case of the previously cited study,⁹ none of the persons reported any adverse effects. Their occurrence depends on the causative factor belonging to one of

three categories: depending on the person performing the procedure, depending on the preparation used during the procedure, and depending on the person who undergoes the procedure.¹⁴ Almost half of the respondents (47.06%) indicated the appearance of edema (Figure 8). Bluish discoloration of the skin, pain, and acid clumping in the mouth were the next most common responses in the study. These are some of the typical immediate side effects.¹⁵ Less frequent responses were skin itching or distorted facial features, which are associated with interactions with the immune system and are called delayed reactions, often chronic.¹⁵

The main task of moisturizing cosmetics is to prevent water loss from the epidermis or to bind it to the skin. Such features are mainly exhibited by humectants, which include HA.¹³ There are many preparations on the market that contain this ingredient, that is, creams for the face, neck, and eyes area, as well as serums, tonics, lotions, gels, foams, masks, and exfoliating preparations. Cosmetics differ in consistency, composition, and purpose.

Preparations containing HA applied externally were an important issue also raised in the survey (Figure 9). Almost twice as many people use this method of application as compared to cosmetology treatments. This represents almost 2/3 of all respondents. This may be due to ease of application (we do not use injections here), as well as the price difference (preparations used externally are usually cheaper than injection procedures). Face creams play a significant role here. They were chosen by over 1/3 of respondents using external HA preparations (Figure 10). This is by far the easiest way to improve the quality of the skin on the entire face because we can apply such a cream strictly to its entire area, not individual parts. Face serum had a slightly smaller share in the survey (31.82%). The respondents also indicated face masks and eye creams, as preparations mostly used "from time to time." Tonics, as well as other preparations used according to the specific needs of the skin, such as intimate hygiene lotions, essences, or peels, obtained the lowest percentage. The result for tonics is surprising. It plays a key role in proper skin care. This is a stage that finishes cleansing the skin and begins moisturizing it. Thanks to this product, skin that has been cleansed with alkaline products can return to its normal pH (in men, it is in the range of 4.3–5.9, and in women, 4.5–5.9).¹⁶

An analysis of the willingness to buy a given product shows that it is most often a personal choice (Figure 11). This confirms the growing awareness of clients of beauty salons, as well as their willingness to verify individual cosmetic products. Such action was facilitated, first of all, by the development of modern technology and access to a range of information via the Internet.¹⁷ However, a study conducted in 2017 proves low awareness, especially among young people (with Internet access), of the composition of the cosmetics they use.¹⁸ It should also be noted that in a study conducted in 2020,¹⁹ 63% of respondents declared the influence of other people on making a decision to purchase a care product. This study also showed third-party influence on decisions by 30% (Figure 11). Such a difference may confirm the above assumptions about increasing awareness of consumers. The so-called "influencers," as the name suggests, are

influential people who build an envelope of authority in their respective areas. In this case, it is the beauty sphere. Such people usually test various types of cosmetics to be able to form an opinion and propose appropriate conclusions. This is a controversial issue, especially when it comes to skincare. Everyone has a different skin type. By trusting a person whose skin requirements may differ radically from ours, consumers may often make decisions which are unfavorable for them. As a result, the purchased products may not meet the requirements of proper care for their skin type. The same applies to product recommendations by friends. It may not always be the right choice, due to possible differences in the requirements of a given skin type. The least important for the respondents are advertisements, recommendations from drugstore consultants, or other, for example, recommendations by family members. The most appropriate option is to get to know your own skin, and its requirements (it is best to go to an experienced cosmetologist for this purpose), and then select the appropriate active ingredients for its actual type.

The packaging, and above all, the manufacturer's promises, which are usually placed on the outside of the package play an important role in making a decision to buy a specific product.¹⁸ According to half of the respondents, the effects promised by the manufacturer were achieved, while 1/3 had no opinion on this subject (Figure 12). Such a result may be caused by unclear advertising of the product or an imprecise explanation of its properties.¹⁸ This result may be due to the achievement of a specific result, attachment to a specific brand, or the "high price equals high quality" mechanism.

Respondents were split evenly when it came to the question on the ingredients found in preparations for external use penetrating deep into the skin (below the epidermis) (Figure 13). An affirmative answer was given by almost 58% of the respondents. According to the HA properties, and in the principle of its macromolecular form, it is impossible for it to pass through the epidermis. It can only create an occlusive layer that allows water to be retained in the epidermis. Additionally, by showing the possibility of combining with the hydrophilic sectors of phospholipids, it increases the hydration of the hydrophilic space and increases its volume. Due to this mechanism, diffusion resistance decreases, which leads to an increase in the permeability of the epidermal layers to other components of a given care preparation.¹³ Individual components can also be placed in structures such as liposomes, but this will only allow them to "overcome" only a few layers of the epidermis, without reaching the dermis.¹⁹

The question of comparing the anti-wrinkle effect for regular use of external care preparations and for injecting with HA depends on the desired effect (Figure 14). With the help of injections, you can get an immediate filling and firming of the skin. At the same time, according to the latest reports, it may also act preventively in the event of further skin problems.¹² Referring strictly to skin care cosmetics, in line with the above conclusions, they can bind water in the epidermis, contributing to reduced drying of the skin. Properly applied care, appropriate to the needs of the skin and, at the same time, started as early as the age of 20, may determine the skin's appearance in old age.²⁰

5 | CONCLUSION

HA plays a significant role in both cosmetology procedures related to injections (dermal fillers) and non-invasive skin care (topical preparations). This substance also plays a minimal but still significant role in oral supplementation or vaginal preparations. Moreover, the awareness of beauty salon clients is on the increase. HA fillers are becoming one of the most frequently chosen options to restore firmness and smoothness of the skin. On the contrary, topical HA preparations applied to the skin help bind water in the epidermis, which slows down the transepidermal water loss process while supporting skin hydration. Side effects are rare and are usually related to the body's immune response. Regular use of HA topical care preparations will not replace the injection of HA, but it will help maintain proper skin hydration and prevent excessive dryness.

AUTHOR CONTRIBUTIONS

Piotr Ratajczak involved in conceptualization, study design, statistical analysis, supervision, and writing the original draft. Oliwia Maciejak involved in conceptualization, data collection, formal analysis, and writing the original draft. Krzysztof Kus involved in statistical analysis and supervision. Dorota Kopciuch, Anna Paczkowska, and Tomasz Zaprutko involved in data collection, data interpretation, and manuscript review. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

Bioethics Committee of the Poznan University of Medical Sciences approved this study on May 6, 2021.

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