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ADAPTIVE EYELASH EXTENSION CONSIDERING THE GROWTH PHASES OF NATURAL EYELASHES ACCORDING TO MARIIA CHEBANENKO METHODOLOGY

Summary. *This scientific article presents an innovative concept of adaptive eyelash extension based on a detailed analysis of the biological growth cycles of natural eyelashes. The methodology developed by Mariia Chebanenko offers a systematic approach to the extension procedure, taking into account the physiological characteristics of each eyelash depending on its growth phase (anagen, catagen, telogen). The study demonstrates that the individual selection of artificial eyelash parameters (length, thickness, curl, volume) in accordance with the physiological state of natural lashes significantly extends the retention period, minimizes discomfort, and the most important thing it's prevent negative effects on the client's eyelash health. Biomechanical aspects of various extension techniques' impact on eyelash structure are examined, and the advantages of the adaptive methodology over traditional approaches are analyzed. The article also addresses issues of age-related changes in eyelash structure and offers strategies for adapting extension techniques to the individual characteristics of clients of different age groups.*

Key words: *eyelash extension, adaptive technique, eyelash growth phases, eyelash anatomy, lash industry, age-related changes, biomechanics of eyelash growth, lash design.*

Introduction. The modern lash industry is developing at a rapid pace, offering clients increasingly advanced eyelash extension technologies. However,

one of the main challenges for technicians remains not only the aesthetic component but also the preservation of the client's natural eyelash health. Adaptive extension, based on the analysis of eyelash growth phases, represents a methodology that allows for extended wear time of extended lashes and minimizes damage to natural eyelashes.

Currently, the market offers numerous extension techniques; however, most of them are primarily oriented toward aesthetic results, insufficiently considering the physiological characteristics of natural eyelash growth. This often leads to premature shedding of extended lashes, discomfort during wear, and, consequently, deterioration of the client's eyelash condition.

This article examines the biological aspects of eyelash growth and their influence on the choice of materials and extension techniques. The key principles of adaptive extension and its prospects in the lash industry are analyzed. Special attention is paid to phase transitions in the eyelash growth cycle and their correlation with artificial material parameters.

Physiology of Eyelash Growth and Its Influence on Extensions

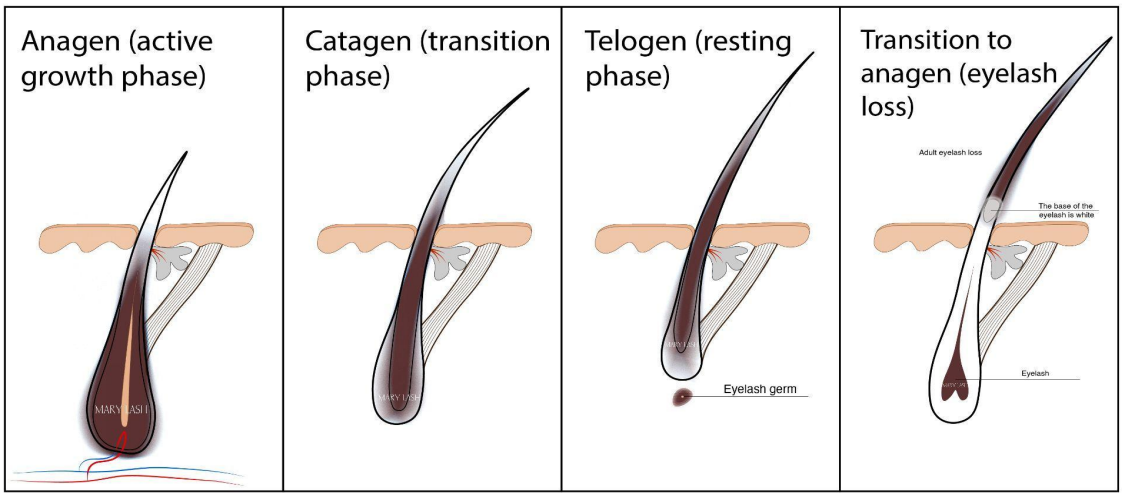
Eyelash growth occurs cyclically and passes through three main phases:

1. **Anagen (active growth phase)** — characterized by active cell division in the hair follicle, which ensures eyelash growth. Up to 40% of upper eyelid lashes are in this phase. The duration of the anagen phase for eyelashes is 30-45 days, significantly shorter than for head hair (2-6 years). During this period, the eyelash root forms, melanin is actively produced, determining its color. Eyelashes in the anagen phase are most vulnerable to mechanical impacts due to the incomplete formation of the hair shaft.

2. **Catagen (transition phase)** — eyelash growth slows down, the bulb contracts, preparing for the end of the life cycle. The duration of this phase is about 15 days. In the catagen phase, gradual keratinization of the hair follicle occurs, eyelash growth stops, but its connection to the follicle remains quite strong.

3. **Telogen (resting phase)** — completion of the growth cycle, the eyelash falls out, making room for a new one. Approximately 50% of eyelashes are in this phase, lasting from 4 to 8 weeks. In the telogen phase, the hair follicle is in a state of rest and then begins a new development cycle, while the old eyelash is pushed out by the newly growing one.

These processes impose certain limitations on the application of various extension techniques. For example, eyelashes in anagen are weaker and require lighter materials, while eyelashes in telogen will soon fall out, affecting extension density.



How Eyelash Growth Stages Affect Extensions?

1. **ANAGEN (growth phase, "young" eyelashes) —** These are short, soft, and thin eyelashes that are just beginning to grow.

Extension recommendations:

- Use minimum length (4-6 mm).
- Take the thinnest diameter (0.03-0.07 mm).
- Apply 1D volume or avoid extending these eyelashes altogether.
- Do not use CC and D curls, as they are very curly in short lengths and will look out of plane with the extended lashes when they grow out.
- Better use B curl for all downy eyelashes.

- Do not overload with volume fans.

- Make an offset from the eyelid of 0.3-0.5 mm.

2. CATAGEN (transition phase, medium-length eyelash, adolescent) — Medium-length eyelashes, strong and more stable.

Extension recommendations:

- Use a length 2-3 mm shorter than the main length.

- Medium diameter is suitable (0.05-0.1 mm).

- Volume can be done, but up to 4D depending on the thickness of natural eyelashes.

- Various curls are permitted depending on eye shape and desired effect.

- Offset from the eyelid 0.7-1 mm.

3. **TELOGEN (resting phase, eyelash ready to fall out)** — Long eyelashes that have reached their maximum length.

Extension recommendations:

- Extend the length according to the chosen scheme, i.e., maximum of all growth stages.

- Thicker eyelashes can be used (0.07-0.1 mm).

- Volume fans are permissible depending on the thickness and length of eyelashes and the corresponding condition of natural eyelashes.

- All types of curls are suitable.

- Standard offset from the eyelid is 1 mm.

When working with classic extensions, adaptivity is primarily manifested in the use of different lengths, and when necessary, different thicknesses and curls.

In the case of volume extensions, adaptivity is expressed not only in the length and thickness of eyelashes but also in the number of lashes in the fan. Volume is built directly proportional to the length of the eyelashes: the longer the natural eyelash, the greater volume it can support.

Mathematical Justification of the Adaptive Approach

To determine the optimal load on a natural eyelash, the following formula can be used:

$W = (T \times L \times S) / P$

where:

W — permissible weight of artificial material

T — thickness of natural eyelash (mm)

L — length of natural eyelash (mm)

S — growth stage coefficient (anagen — 0.6, catagen — 0.8, telogen — 1.0)

P — correction coefficient for eyelash condition (normal — 1.0, weakened — 1.2, damaged — 1.5)

This formula allows calculating the safe load and selecting optimal parameters of artificial eyelashes for each individual lash.

Advantages of Adapting Extensions to Eyelash Growth Phase:

Extends the wear time of extensions, as it minimizes overloading of weak lashes.

Reduces the risk of damage to natural eyelashes.

Makes grown-out eyelashes more natural — without sharp transitions in length and weight.

Helps the technician create beautiful transitions between volumes, making the extension more smooth and natural.

Improves client comfort, especially in the late stages of wear (2-3 weeks after the procedure).

Reduces correction time due to more uniform shedding of eyelashes.

Minimizes the risk of allergic reactions by reducing the contact of adhesive with the eyelids.

The main indicator of adaptive extension quality is that eyelashes look very beautiful and neat after 3-4 weeks, with no sagging lashes, discomfort, all grown-

out lashes are in the same plane, grown-out lashes are not visible, and the extension does not affect the health of natural eyelashes.

Thus, **adaptive extension considering the phases of eyelash growth** is a technique that makes the technician's work more professional, and the result is maximally comfortable and long-lasting for the client.

Also, the extension looks more natural, as the perfect smooth line is no longer in demand by clients, and clients who have already tried extension with the adaptive technique note a big difference in wear, comfort, and durability. Extension with the adaptive technique is like your own eyelashes, but looks better.

Consequences of Not Using Adaptive Eyelash Extensions

If adaptive eyelash extension is not performed, the following negative consequences may occur:

1. Overloading of Natural Eyelashes

- Using too heavy or long artificial eyelashes without considering the growth phase can lead to breakage and premature shedding.

- Weak eyelashes in the anagen phase cannot withstand the load, which can lead to a change in the growth direction of natural eyelashes.

- In the long term, excessive load can lead to thinning of the client's own eyelashes and damage to the follicles.

2. Uneven Effect and Low Durability

- Eyelashes in the telogen phase will soon fall out, creating gaps in the extension and deteriorating the aesthetic result.

- Uneven load will lead to rapid thinning and weakening of the eyelash structure.

- The resulting gaps require more frequent corrections, which increases the cost of the procedure for the client and increases the load on natural eyelashes.

3. Irritation and Discomfort

- When extending downy eyelashes to full length, they will quickly grow out, and due to the weight of the artificial eyelash, they will sag and bother the client, and the eyelash will change its growth direction.

- Often, in the absence of adaptive technique in extension, grown-out eyelashes bother the client, and the client constantly adjusts the eyelashes and may mechanically tear out the grown-out eyelash along with the natural one, which will be very painful and create a gap in natural eyelashes that will need to be filled with a larger volume of eyelashes.

- In severe cases, blepharitis — inflammation of the eyelid margins requiring treatment and rejection of extensions for an extended period — may develop.

4. Reduction in Correction Quality

- Failure to consider individual growth characteristics leads to uneven shedding of extended eyelashes, complicating subsequent corrections.

- The client may require more frequent corrections, increasing the risk of damage to natural eyelashes.

- Improper correction can exacerbate existing problems and create a "bald spot" effect on the eyelash growth line.

5. Long-term Deterioration of Eyelash Condition

- If eyelashes are constantly overloaded, hair follicle damage is possible, which will slow their growth.

- This is especially critical for older clients, as hair follicle regeneration is already slowed.

- In some cases, trichoptilosis (splitting of the tips) of natural eyelashes may occur, requiring special care and treatment.

Health of Natural Eyelashes and Technical Parameters of Extensions

The health of natural eyelashes plays a key role in the lash industry. The basic principles ensuring client safety and comfort are:

Complete autonomy of each artificial eyelash, preventing the bonding of natural eyelashes to each other.

Maintaining an offset of 0.5-1 mm from the eyelid to prevent irritation and damage to hair follicles.

Using ultra-light materials corresponding to the condition of natural eyelashes.

Optimal distribution of load on natural lashes, considering their individual characteristics.

Application of hypoallergenic adhesive compositions with minimal formaldehyde content.

Correction considering the growth phase of natural eyelashes and previous extension.

Consideration of the general condition of eyelashes, presence of eyelid diseases, and contraindications.

Regular updating of the technician's knowledge about new technologies and materials.

Failure to comply with these parameters can lead to weakening, brittleness, and loss of eyelashes, as well as cause discomfort for the client, eyelid irritation, allergic reactions, and other undesirable consequences.

Age-related Features of Eyelash Extensions

With age, the structure and growth characteristics of eyelashes undergo significant changes that must be considered in adaptive extension:

1. Clients aged 18-25:

- High rate of hair follicle regeneration
- More stable eyelash structure
- A greater variety of techniques possible

2. Clients aged 25-40:

- Moderate rate of eyelash renewal

- Possible periodic growth disturbances related to hormonal factors (pregnancy, stress)

- More careful selection of materials required

3. Clients aged 40-55:

- Slowing of the eyelash growth cycle

- Thinning of the hair structure

- Need for lighter materials and gentler techniques

4. Clients over 55:

- Significant slowing of regeneration

- Weakening and thinning of eyelashes

- Only light materials and minimal volumes recommended

- Extension with an offset of not less than 1mm from the eyelid

Conclusion

Adaptive eyelash extension represents an advanced approach in the lash industry, based on a deep understanding of the physiology of eyelash growth and biomechanical principles of load distribution. This methodology, developed based on years of research and practical experience, allows optimizing the extension process considering the individual characteristics of each client.

The key feature of the adaptive approach lies in the differentiated selection of materials and techniques depending on the growth phase of each eyelash (anagen, catagen, telogen). Such a personalized approach provides not only an excellent aesthetic result but also maximum care for the health of the client's natural eyelashes. The study results convincingly demonstrate that considering the physiological cycles of eyelash growth significantly improves comfort during wear, extends the service life of extended eyelashes, and minimizes the risk of negative impact on the structure of natural lashes.

The implementation of mathematical models for calculating the optimal load on eyelashes of various categories opens new perspectives for standardization and increasing the scientific validity of extension procedures.

This allows transforming the lash industry from a predominantly craft sphere into a field based on scientific principles and an evidence-based approach.

In the conditions of growing competition in the lash services market, adaptive extension becomes a significant competitive advantage for technicians concerned about the long-term results of their work and client health. The growing demand for naturalness and comfort, combined with high aesthetic standards, makes the adaptive approach particularly relevant.

Further development of the methodology is seen in the direction of in-depth study of the influence of various factors (age, hormonal background, seasonality, environmental factors) on eyelash growth cycles and adaptation of extension techniques to these variables. The development of new biocompatible materials, specialized for different phases of eyelash growth, and the creation of software for automated calculation of optimal extension parameters based on digital analysis of the client's eyelash condition also appear promising.

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