

# БИОМЕДИЦИНА ВА АМАЛИЁТ ЖУРНАЛИ

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**ISLAMOVA Nilufar Bustanovna**

PhD, dots.


**NURULLAYEVA Guzal Abdumalikovna**

Master's resident

Samarkand State Medical University, Uzbekistan

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**ANNOTATION**

This study focuses on improving adhesive technologies for the prevention of post-bleaching complications. Hydrogen peroxide and high-concentration carbamide peroxide used in tooth bleaching may adversely affect enamel and dentin microstructure and reduce adhesive bond strength. Increased hydrodynamic fluid movement within dentinal tubules after bleaching often results in tooth hypersensitivity. The study evaluated the effects of peroxide-based agents on enamel microhardness, adhesive bond strength, and clinical sensitivity. A comparative assessment of antioxidant treatment and bioactive universal adhesive application after bleaching was conducted. The results demonstrated that a comprehensive approach reduces hypersensitivity, enhances bond strength, and promotes remineralization of enamel. Optimization of adhesive protocols after bleaching significantly improves clinical outcomes and patient quality of life.

**Keywords:** dental varnishes; dental adhesive systems; bioactive adhesive; remineralization; hypersensitivity; microhardness; aesthetic dentistry.

**ИСЛАМОВА Нилуфар Бустановна**

PhD, доцент

**НУРУЛЛАЕВА Гузал Абдумаликовна**

Резидент магистратуры

Самаркандский Государственный Медицинский Университет, Узбекистан

**СОВЕРШЕНСТВОВАНИЕ ПРИМЕНЕНИЯ АДГЕЗИВНЫХ ТЕХНОЛОГИЙ ДЛЯ  
ПРОФИЛАКТИКИ ОСЛОЖНЕНИЙ ПОСЛЕ ОТБЕЛИВАНИЯ ЗУБОВ****АННОТАЦИЯ**

Исследование посвящено совершенствованию применения адгезивных технологий для профилактики осложнений после отбеливания зубов. Перекись водорода и

высококонцентрированная перекись карбамида могут оказывать негативное влияние на микроструктуру эмали и дентина, а также снижать прочность адгезивного соединения. После процедуры усиливается гидродинамический поток в дентинных канальцах, что приводит к гиперестезии. В работе оценено влияние пероксидных средств на микротвёрдость эмали, прочность адгезии и клиническую чувствительность. Проведено сравнительное исследование эффективности антиоксидантной обработки и применения биоактивного универсального адгезива после отбеливания. Полученные результаты показали, что комплексный подход способствует снижению гиперестезии, повышению прочности адгезии и восстановлению минерального баланса эмали. Оптимизация адгезивных технологий повышает клиническую эффективность лечения и улучшает качество жизни пациентов.

**Ключевые слова:** дисколорит зубов; стоматологические лаки; стоматологические адгезивные системы; биоактивный адгезив; реминерализация; гиперестезия; микротвёрдость; эстетическая стоматология.

**ISLAMOVA Nilufar Bo'stonovna**

PhD, dots.

**NURULLAYEVA Go'zal Abdumalikovna**

Magistratura rezidenti

Samarqand Davlat Tibbiyot Universiteti, O'zbekiston

## **TISHLARNI OQARTIRISHDAN KEYINGI ASORATLAR PROFILAKTIKASI UCHUN ADGEZIV TEXNOLOGIYALARNI QO'LLASHNI TAKOMILLASHTIRISH**

### **ANNOTATSIYA**

Mazkur tadqiqot tishlarni oqartirishdan keyingi asoratlar profilaktikasida adgeziv texnologiyalarni qo'llashni takomillashtirishga bag'ishlangan. Oqartirish jarayonida qo'llaniladigan vodorod peroksid va yuqori konsentratsiyali karbamid peroksid emal va dentin mikrostrukturasi hamda adgeziv bog'lanish kuchiga salbiy ta'sir ko'rsatishi mumkin. Oqartirishdan keyin dentin naychalari orqali gidrodinamik oqim kuchayib, tishlar giperesteziyasi yuzaga keladi. Tadqiqotda peroksidli vositalarning emal mikroqattiqligi, adgeziv bog'lanish kuchi va klinik sezuvchanlikka ta'siri baholandi. Oqartirishdan keyingi davrda antioksidant ishlov berish va bioaktiv universal adgeziv tizimlardan foydalanish samaradorligi qiyosiy o'rganildi. Natijalar kompleks yondashuv qo'llanilganda giperesteziya darajasi kamayishi, adgeziv bog'lanish kuchi oshishi va emalning mineral balansini tiklash tezlashishini ko'rsatdi. Oqartirishdan keyingi asoratlarni kamaytirishda adgeziv texnologiyalarni optimallashtirish klinik samaradorlikni sezilarli oshiradi hamda bemorlar hayot sifatini yaxshilaydi.

Kalit so'zlar: tishlar diskoloriti, stomatologik laklar, stomatologik adgeziv tizimlar, bioaktiv adgeziv, remineralizatsiya, giperesteziya, mikroqattiqlik, estetik stomatologiya.

### **Kirish**

So'nggi yillarda O'zbekiston Respublikasida sog'liqni saqlash tizimini tubdan isloh qilish, tibbiy xizmat sifatini oshirish hamda xalqaro standartlarga moslashtirish bo'yicha keng ko'lamli chora-tadbirlar amalga oshirilmoqda. Xususan, O'zbekiston Respublikasi Sog'liqni saqlash vazirligi tomonidan stomatologik yordamni modernizatsiya qilish, davlat va xususiy sektor integratsiyasini rivojlantirish, yuqori texnologiyali diagnostika va davolash usullarini joriy etish ustuvor yo'nalish sifatida belgilangan. Hozirgi kunda stomatologiyada estetik davolash usullariga bo'lgan talabning ortib borishi tishlarni Oqartirish muolajalarining keng qo'llanilishiga olib kelmoqda [1,3]. Oqartirish jarayonida qo'llaniladigan peroksid asosidagi preparatlar emal va dentin tuzilmasiga ta'sir etib, ularning minerallasuv darajasini kamaytirishi, tish sezuvchanligining ortishi, mikro yoriqlar paydo bo'lishi hamda kariyes rivojlanish xavfining kuchayishiga sabab bo'lishi mumkin. Ushbu asoratlar Oqartirishdan keyingi davrda profilaktik choralarni ilmiy asosda ishlab chiqish zaruratini yuzaga keltirmoqda [2].

So'nggi yillarda stomatologiyada adgeziv texnologiyalar faol rivojlanib, ularning remineralizatsiya qiluvchi, himoya qatlam hosil qiluvchi va emal strukturasi mustahkamlovchi xususiyatlari aniqlanmoqda. Oqartirishdan keyin adgeziv tizimlarni qo'llash orqali emalning mikrostrukturaviy o'zgarishlarini bartaraf etish, tish sezuvchanligini kamaytirish hamda Oqartirish muolajasining uzoq muddatli samaradorligini saqlab qolish imkoniyati mavjud.

Shu bilan birga, Oqartirishdan keyingi asoratlarning oldini olishda adgeziv texnologiyalarni qo'llashning optimal usullari, klinik samaradorligi va biologik mosligi hali yetarli darajada tizimli o'rganilmagan. Mavjud tadqiqotlar ko'pincha Oqartirish natijasining estetik jihatlariga qaratilgan bo'lib, Oqartirishdan keyingi davrda profilaktika masalalari yetarlicha yoritilmagan[4,5].

Shu munosabat bilan, Oqartirishdan keyingi asoratlarni profilaktikasi uchun adgeziv texnologiyalarni qo'llashni takomillashtirishga qaratilgan ilmiy izlanishlar dolzarb hisoblanadi. Ushbu yo'nalishda olib boriladigan tadqiqotlar Oqartirish muolajalarining xavfsizligini oshirish, bemorlarning hayot sifatini yaxshilash va estetik stomatologiya amaliyotini yanada takomillashtirishga xizmat qiladi[5,6].

Mamlakatda estetik stomatologiyaga bo'lgan talabning ortishi natijasida tishlarni oqartirish, minimal invaziv restavratsiya va adgeziv texnologiyalarni keng qo'llash amaliyoti sezilarli darajada kengaydi. Zamonaviy klinikalarda xalqaro protokollarga asoslangan davolash usullarini joriy etish, stomatolog mutaxassislarining malakasini oshirish va ilmiy-tadqiqot faoliyatini qo'llab-quvvatlash bo'yicha tizimli ishlar olib borilmoqda. Bundan tashqari, sog'lom turmush tarzini targ'ib qilish, aholi orasida og'iz bo'shlig'i gigiyenasi madaniyatini oshirish hamda profilaktik stomatologiyani rivojlantirish davlat siyosatining muhim yo'nalishlaridan biri hisoblanadi. Oqartirish muolajalari sonining ortishi bilan birga, ularning asoratlarni kamaytirish, bemor xavfsizligini ta'minlash va uzoq muddatli klinik natijalarga erishish masalalari ilmiy tadqiqotlarning ustuvor vazifasiga aylanmoqda. So'nggi yillarda estetik stomatologiyaning jadal rivojlanishi hamda aholining tashqi ko'rinishga bo'lgan talabining ortishi tishlarni Oqartirish muolajalarining klinik amaliyotda keng qo'llanilishiga olib kelmoqda. Oqartirish jarayonida ishlatiladigan peroksid va boshqa oksidlovchi moddalar emal va dentinning organik hamda noorganik komponentlariga ta'sir ko'rsatib, ularning kristall panjarasida strukturaviy o'zgarishlarni yuzaga keltiradi. Natijada emalning mikroqattiqligi pasayadi, uning g'ovakligi ortadi, tish sezuvchanligi kuchayadi hamda kariyesga moyillik oshadi[7].

Ilmiy adabiyotlarda Oqartirishdan keyingi davrda emal yuzasida demineralizatsiya jarayonlarining faollashuvi, remineralizatsiya jarayonlarining esa yetarli darajada kompensatsiyalanmasligi qayd etilgan. Mazkur holat Oqartirish muolajalaridan so'ng profilaktik yondashuvlarni patogenetik jihatdan asoslab ishlab chiqish zaruratini belgilaydi. Shu nuqtai nazardan, Oqartirishdan keyingi asoratlarning oldini olish faqat desensibilizatsiyalovchi vositalar bilan cheklanib qolmasdan, balki emal yuzasida barqaror himoya qatlam hosil qiluvchi texnologiyalarni qo'llashni taqozo etadi[8].

Adgeziv texnologiyalar stomatologiyada biologik mosligi, yuqori bog'lanish kuchi va emal mikrorelyefini germetik yopish qobiliyati bilan ajralib turadi. Oqartirishdan keyin adgeziv tizimlardan foydalanish emal yuzasida rezistent plyonka hosil bo'lishiga, ion almashinuvining normallashtirishiga va mineral komponentlarning saqlanib qolishiga imkon yaratadi. Shu bilan birga, adgeziv materiallarning Oqartirishdan keyin o'zgaragan emal strukturasi ta'siri, ularning uzoq muddatli klinik samaradorligi hamda biologik xavfsizligi yetarlicha chuqur o'rganilmagan.

Mavjud ilmiy ishlarda asosan Oqartirishning estetik samaradorligi va rang barqarorligi masalalari yoritilgan bo'lib, Oqartirishdan keyingi asoratlarning patogenezigacha qaratilgan profilaktik strategiyalar ikkinchi darajali masala sifatida ko'rib chiqilgan. Oqartirishdan keyingi davrda adgeziv texnologiyalarni qo'llashning differensial va kompleks yondashuvlari bo'yicha yagona klinik protokollarning yo'qligi mazkur yo'nalishda ilmiy asoslangan tavsiyalar ishlab chiqish zaruratini ko'rsatadi[9].

Shu bois, Oqartirishdan keyingi asoratlarni profilaktikasi uchun adgeziv texnologiyalarni qo'llashni takomillashtirishga qaratilgan tadqiqotlar ilmiy va amaliy jihatdan dolzarb hisoblanadi. Ushbu yo'nalishdagi izlanishlar Oqartirish muolajalarining biologik xavfsizligini oshirish, emalning

strukturaviy barqarorligini ta'minlash hamda estetik stomatologiyada uzoq muddatli klinik natijalarga erishish imkonini beradi[10,11].

Shu bois, tishlarni oqartirishdan keyingi asoratlar profilaktikasi uchun adgeziv texnologiyalarni qo'llashni takomillashtirish bo'yicha ilmiy izlanishlar olib borish nafaqat nazariy, balki amaliy sog'liqni saqlash tizimi uchun ham muhim ahamiyat kasb etadi.

### **Maqsad**

Klinik tahliliy tadqiqotlar asosida tishlarni oqartirishdan keyin giperesteziyani oldini olishda adgeziv texnologiyalarni qo'llashni takomillashtirish

### **TADQIQOT MATERIALLARI VA USULLARI**

Tadqiqot klinik-eksperimental yo'nalishda olib borildi va estetik stomatologiya amaliyotida tishlarni oqartirishdan keyingi asoratlar profilaktikasi uchun adgeziv texnologiyalarni takomillashtirish samaradorligini baholashga qaratildi.

Tadqiqot obyekti va guruhi

Tadqiqotda 18–40 yosh oralig'idagi 60 nafar bemor ishtirok etdi. Bemorlar tasodifiy tanlash (randomizatsiya) usuli orqali 3 ta guruhga ajratildi:

I-guruh (nazorat guruhi, n=20) – Oqartirishdan so'ng an'anaviy adgeziv tizim qo'llanildi.

II-guruh (n=20) – Oqartirishdan so'ng 10% natriy askorbat eritmasi bilan antioksidant ishlov berilib, universal adgeziv qo'llanildi.

III-guruh (n=20) – Oqartirishdan so'ng remineralizatsion terapiya (nano-gidroksiapatit asosidagi preparat) hamda bioaktiv universal adgeziv tizim qo'llanildi.

Tadqiqotga kiritish mezonlari: sog'lom umumiy somatik holat, oldingi restavratsiyalarsiz frontal tishlar, emal defektlarining yo'qligi.

Chiqarish mezonlari: klinik kariyes, pulpit, parodont kasalliklari, homiladorlik, allergik anamnez mavjudligi.

Oqartirish protokoli

Barcha guruhlarda ofis sharoitida 35% vodorod peroksid asosidagi oqartirish geli qo'llanildi. Oqartirish 2 seans davomida, har biri 15 daqiqalik ekspozitsiya bilan amalga oshirildi. Oqartirishdan keyin tish yuzalari distillangan suv bilan yuvildi va quritildi.

Adgeziv protokollar

An'anaviy total-etch tizimi (37% ortofosfor kislotasi bilan 15 soniya travleniye).

Universal adgeziv tizimi (10-MDP monomerli).

Bioaktiv komponentli universal adgeziv (kalsiy-fosfat va nano-gidroksiapatit tarkibli).

Restavratsiya uchun nanogibrid kompozit material qo'llanildi. Polimerizatsiya LED-lampa yordamida 20 soniya davomida amalga oshirildi (1000–1200 mW/sm<sup>2</sup>).

Klinik baholash mezonlari

Tishlar giperesteziyasi – vizual-analog shkala (VAS, 0–10 ball) asosida baholandi.

Emal mikroqattiqligi – Vickers mikrotverdomer usuli bilan o'lchandi (HV birliklarda).

Adgeziv bog'lanish kuchi – shear bond strength (MPa) laborator sharoitda aniqlanildi.

Marginal germetiklik – bo'yovchi penetratsiya testi orqali baholandi.

Klinik kuzatuv – 1 hafta, 1 oy va 3 oy davomida olib borildi.

### **Statistik ma'lumotlarni qayta ishlash**

Olingan natijalar matematik-statistik usullar yordamida qayta ishlanib, o'rtacha arifmetik qiymat (M), standart og'ish ( $\pm m$ ) hisoblandi. Guruhlararo farqlar Student t-testi va ANOVA dispersiya tahlili yordamida baholandi. Ishonchlilik darajasi  $p < 0,05$  deb qabul qilindi. Statistik hisob-kitoblar zamonaviy kompyuter dasturlari asosida amalga oshirildi. Tadqiqot bioetika me'yorlariga muvofiq ravishda o'tkazildi. Barcha ishtirokchilardan yozma ravishda xabardor qilingan rozilik olindi. Tadqiqot protokoli mahalliy bioetika komissiyasi tomonidan tasdiqlandi.

### **Tadqiqot natijalari**

Bemorlarning klinik tavsifi va davolash hajmi

Oqartirishdan keyingi giperesteziya ko'rsatkichlari

Jadval 1. VAS shkalasi (0–10 ball) asosida olingan natijalar shuni ko‘rsatdiki, oqartirishdan 24 soat o‘tib

Guruhlar soni	Qo‘llanuvchi modda	Ball
I-guruh	nazorat	6,8 ± 0,4 ball
II-guruh	antioksidant + universal adgeziv	4,1 ± 0,3 ball
III-guruh	remineralizatsiya + bioaktiv adgeziv	2,3 ± 0,2 ball

Jadval 2. VAS shkalasi (0–10 ball) asosida olingan natijalar shuni ko‘rsatdiki, oqartirishdan 1 oy o‘tgach:

Guruhlar soni	Qo‘llanuvchi modda	Ball
I-guruh	nazorat	3,2 ± 0,3ball
II-guruh	antioksidant + universal adgeziv	1,4 ± 0,2ball
III-guruh	remineralizatsiya + bioaktiv adgeziv	0,8 ± 0,1ball

Izoh: Jadvaldan ko‘rinib turibdiki, III-guruhda giperesteziya ko‘rsatkichlari nazorat guruhiga nisbatan ishonchli darajada past bo‘ldi ( $p < 0,05$ ).

Emal mikroqattiqligi (Vickers, HV)

Oqartirishdan oldin barcha guruhlarda o‘rtacha mikroqattiqlik 285–290 HV ni tashkil etdi.

Jadval 3. Oqartirishdan 7 kun o‘tgach:

Guruhlar soni	Emal mikroqattiqligi ko‘rsatkichi
I-guruh	248 ± 5 HV
II-guruh	265 ± 4 HV
III-guruh	278 ± 3 HV

Izoh: Bioaktiv adgeziv va remineralizatsiya qo‘llangan III-guruhda mikroqattiqlik deyarli boshlang‘ich ko‘rsatkichga yaqinlashdi.

Marginal germetiklik

Jadval 4. Bo‘yovchi penetratsiya testi natijalariga ko‘ra:

Guruhlar soni	Mikrooqish ko‘rsatkichi (%)
I-guruhda	30%
II-guruhda	15%
III-guruhda	5%

Izoh: Olingan ma‘lumotlar shuni ko‘rsatadiki, oqartirishdan keyingi davrda an’anaviy adgeziv tizim qo‘llanishi giperesteziya va bog‘lanish kuchining pasayishiga olib keladi. Oqartirish jarayonida hosil bo‘ladigan qoldiq kislorod radikallari kompozit material polimerizatsiyasini susaytiradi.

Antioksidant (natriy askorbat) bilan ishlov berish II-guruhda bog‘lanish kuchini oshirdi, bu oksidlovchi radikallarni neytrallash bilan izohlanadi.

III-guruhda remineralizatsion terapiya va bioaktiv universal adgeziv qo‘llanilishi emal strukturasi tiklash, dentin naychalarini yopish va kimyoviy bog‘lanishni mustahkamlash hisobiga eng yaxshi klinik natijalarni berdi.

### Natijalarni muhokama qilish

Olingan ma'lumotlar shuni ko'rsatdiki, oqartirishdan keyingi davrda an'anaviy adgeziv tizim qo'llanishi giperesteziya va bog'lanish kuchining pasayishiga olib keladi. Oqartirish jarayonida hosil bo'ladigan qoldiq kislorod radikallari kompozit material polimerizatsiyasini susaytiradi.

Antioksidant (natriy askorbat) bilan ishlov berish II-guruhda bog'lanish kuchini oshirdi, bu oksidlovchi radikallarni neytrallashtirish bilan izohlanadi.

III-guruhda remineralizatsion terapiya va bioaktiv universal adgeziv qo'llanilishi emal strukturasi tiklash, dentin naychalarini yopish va kimyoviy bog'lanishni mustahkamlash hisobiga eng yaxshi klinik natijalarni berdi.

10-MDP monomer asosidagi adgezivlar gidroksiapatit bilan kimyoviy bog'lanish hosil qilishi natijasida uzoq muddatli mustahkamlik ta'minlandi.

Oqartirishdan keyingi davrda bioaktiv universal adgeziv va remineralizatsion terapiyani kompleks qo'llashning klinik samaradorligi birinchi marta qiyosiy baholandi.

Oqartirishdan keyingi adgeziv bog'lanish kuchining pasayish mexanizmi klinik-statistik asosda tahlil qilindi.

Oqartirishdan keyingi asoratlar profilaktikasi uchun optimallashtirilgan klinik protokol ishlab chiqildi.

#### AMALIY AHAMIYATI

Oqartirishdan keyingi restavratsiyalarda universal bioaktiv adgeziv tizimlardan foydalanish tavsiya etiladi.

Oqartirishdan so'ng kamida 7 kun remineralizatsion terapiya o'tkazish klinik jihatdan maqsadga muvofiq.

Antioksidant ishlov berish adgeziv bog'lanish sifatini oshiradi.

Tavsiya etilgan protokol giperesteziya darajasini 2–3 barobarga kamaytiradi.

#### Xulosa

Mazkur tadqiqot natijalari shuni ko'rsatdiki, tishlarni oqartirish amaliyoti estetik stomatologiyada keng qo'llaniladigan, samarali va nisbatan xavfsiz minimal invaziv muolaja bo'lib, bemorlarning tashqi ko'rinishi va hayot sifatini sezilarli oshirishga xizmat qiladi. Biroq oqartirish jarayonida qo'llaniladigan peroksid asosidagi preparatlar emal va dentin mikrostrukturasi ustida ma'lum darajada salbiy ta'sir ko'rsatishi mumkin. Ushbu ta'sirlar orasida emal yuzasining g'ovaklashuvi, mikroyoriqlar paydo bo'lishi, dentin naychalari orqali gidrodinamik oqimning kuchayishi va natijada giperesteziya rivojlanishi muhim o'rin tutadi.

Tadqiqot shuni ko'rsatdiki, oqartirishdan keyingi asoratlarni kamaytirish va adgeziv bog'lanish kuchini oshirishda zamonaviy adgeziv texnologiyalar, xususan bioaktiv universal adgezivlar va remineralizatsion preparatlar samarali vosita sifatida ishlatilishi mumkin. Antioksidant ishlov berish va remineralizatsion terapiya qo'llanilganda giperesteziya darajasi sezilarli kamayadi, emal mikroqattiqligi saqlanadi va adgeziv bog'lanish kuchi oshadi. Bu esa tishlarni oqartirishdan keyingi restavratsiyalarda uzoq muddatli klinik barqarorlikni ta'minlaydi.

Shuningdek, tadqiqot natijalari tishlar diskoloriti sabablari, vital tishlardagi diskoloritlarni bartaraf etishning zamonaviy usullari, oqartirishning tish qattiq to'qimalariga ta'siri, giperesteziya davolash usullari va stomatologik adgeziv tizimlarning samaradorligini birlashtirilgan tarzda o'rganish imkonini berdi. Natijalar shuni ko'rsatdiki, kompleks yondashuv qo'llash tishlar estetik va funktsional holatini saqlash, bemorlarning hayot sifati va qoniqish darajasini oshirishga xizmat qiladi.

Shu bilan birga, tishlarni oqartirishdan keyingi asoratlarni profilaktika qilishda adgeziv protokollarni optimallashtirish, bioaktiv komponentlarni qo'llash va remineralizatsiyani rag'batlantirish stomatologiyaning amaliy yo'nalishlari uchun muhim ilmiy va klinik ahamiyatga ega. Kelgusida ushbu yo'nalishda qo'shimcha klinik tadqiqotlar olib borish, turli preparat va adgeziv tizimlarning uzoq muddatli samaradorligini baholash tavsiya etiladi.

Natijada, maqola tishlarni oqartirishdan keyingi asoratlarni samarali oldini olish, bemor xavfsizligini ta'minlash va estetik stomatologiya amaliyotini yanada takomillashtirish bo'yicha ilmiy-amaliy tavsiyalarni shakllantirishga xizmat qiladi.

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