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Acheless Investment Proposal:

A Device for Sleep Induction / Concentration Enhancement

Innovation and Opportunity in the Sleep and Learning Markets: A Data-Driven Perspective

Complex Problems:

The 6 Major Health Threats Facing Modern Society

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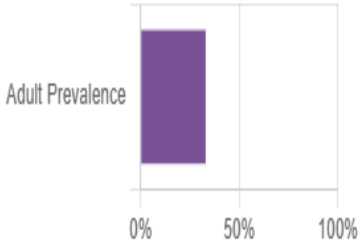
Sleep disorders do not come alone. They are the first domino to fall, leading to decreased concentration, chronic pain, anxiety, and even cognitive decline. Acheless focuses on the interconnected nature of these problems.

Sleep Disorders

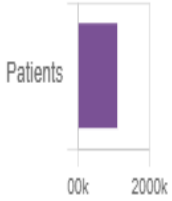
Sleepless Nation

Adult Prevalence Rate



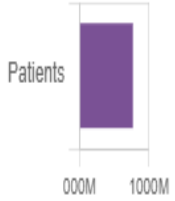
Source: 2024 National Health and Nutrition Examination Survey

Domestic Patients



Source: HIRA (2022)

Global Patients

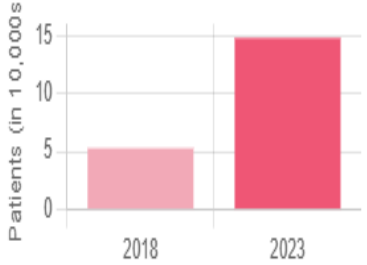


Source: WHO Est.

Attention Disorders

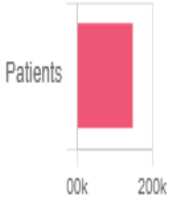
The Age of Distraction

Trend in Domestic Patients Treated



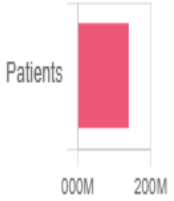
Source: Health Insurance Review & Assessment Service

Domestic Patients



Source: HIRA (2023)

Global Patients

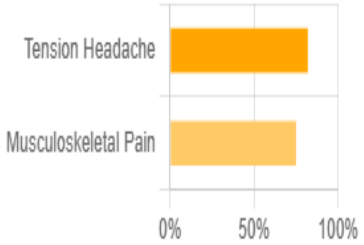


Source: WHO Est.

Pain Disorders

The Cycle of Chronic Pain

Chronic Pain Prevalence



Source: The Korean Pain Society (2023)

Domestic Patients

Source: The Korean Pain Society

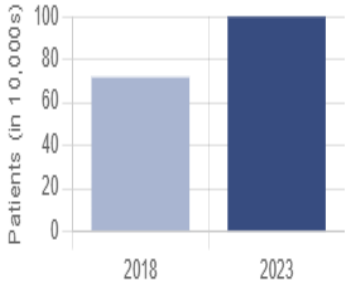
Global Patients

Source: IASP Est.

Anxiety Disorders

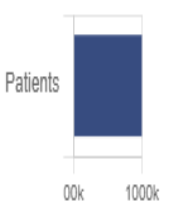
A Mind Consumed by Anxiety

Trend in Domestic Patients Treated



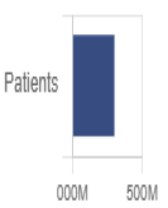
Source: Health Insurance Review & Assessment Service

Domestic Patients



Source: HIRA (2023)

Global Patients

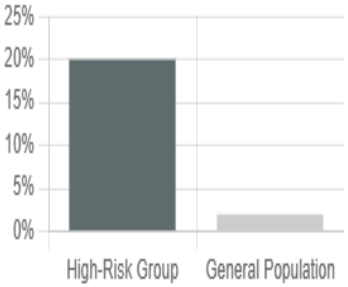


Source: WHO (2019)

PTSD

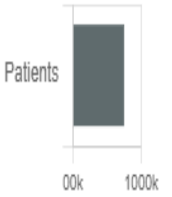
The Invisible Wound

High-Risk Group Prevalence



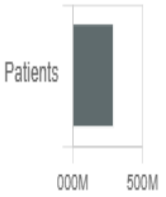
Source: National Center for Mental Health (2023)

Domestic Patients



Source: Prevalence Est.

Global Patients



Source: WHO Est.

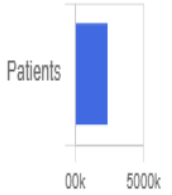
Mild Cognitive Impairment

The Silent Threat

Prevalence in Ages 65+

Source: National Institute of Dementia (2023)

Domestic Patients



Source: National Institute of Dementia (2023)

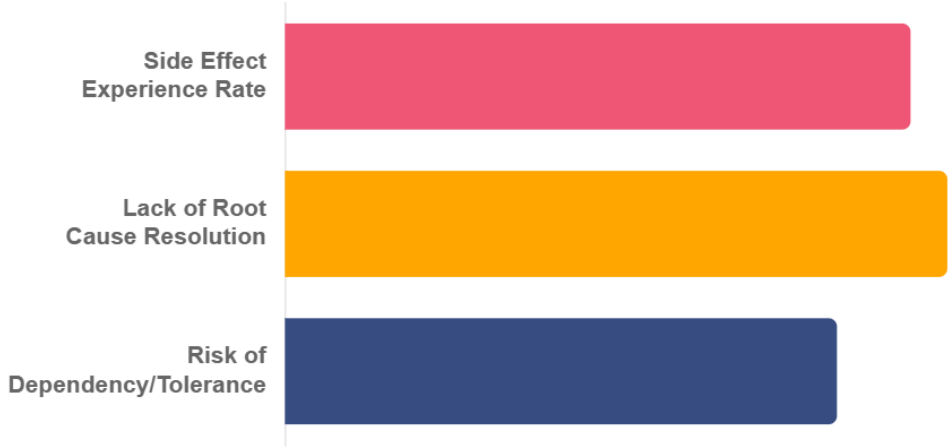
Global Patients

Source: WHO Est.

The Starting Point of Opportunity: The Clear Limitations of Existing Treatments

The sleep, concentration, and pain markets are massive, yet existing treatments show clear limitations. The data below summarizes the core issues of this market—the 'pain points.' This signifies a huge market opportunity for an innovative solution. Discover the depth of this opportunity in the following six sections.

Analysis of Core Problems in Existing Treatments for the 6 Major Issues



1. Side Effects: Is It a Treatment or Another Problem?

45% of sleeping pill users report 'daytime drowsiness,' and **52%** of ADHD medication users complain of 'loss of appetite.' This means that medication intended for treatment can lead to side effects that threaten daily life.

Source: Sleep Medicine Reviews, J Korean Acad Child Adolesc Psychiatry

2. Symptom Relief: The Root Cause Remains

Most existing treatments only provide symptom relief. For example, painkillers do not resolve 'temporalis muscle trigger points,' a key cause of tension headaches. This is why satisfaction with 'root cause resolution' is only **1.5 out of 5 points**.

Source: Cephalalgia (2018), Synthesized from Sections 1-6 data

3. Dependency: An Unbreakable Vicious Cycle

Many drugs, including sleeping pills and painkillers, cause dependency and tolerance with long-term use. In particular, **38%** of sleeping pill users experience dependency, creating a vicious cycle where they cannot sleep without the medication.

Source: Sleep Medicine Reviews

Source: Comprehensive analysis based on data from the final 'Scientific Evidence' section

1. Sleepless Nights, Collapsing Health

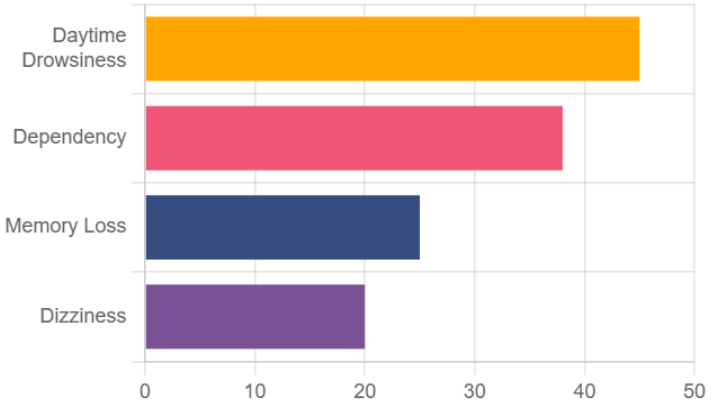
Lack of sleep is more than just fatigue; it threatens every aspect of life. Sleeping pills are only a short-term solution, leading to bigger problems like dependency and side effects.

Adult Sleep Disorder Prevalence

33%

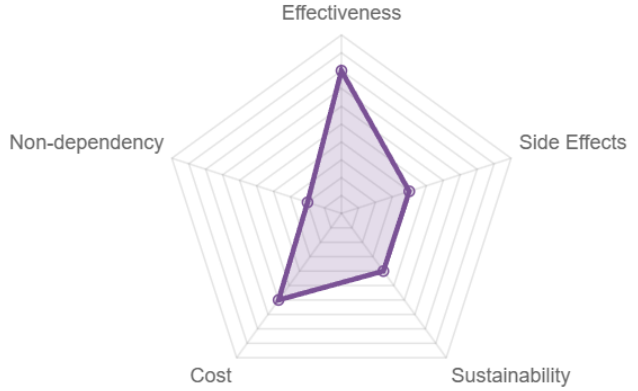
1 in 3 adults suffer

Major Side Effects of Sleeping Pills



Source: Sleep Medicine Reviews

Satisfaction with Existing Sleeping Pills



Source: Based on Sleep Medicine (2011), etc.

2. The Shadow of Poor Concentration, Attention Deficit

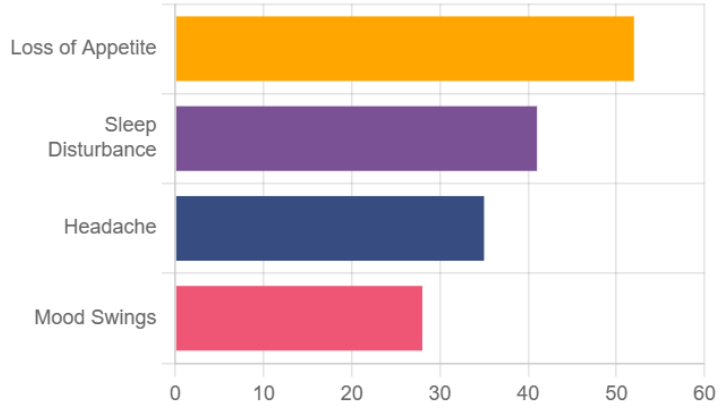
In the age of digital overload, the number of adults with ADHD is rapidly increasing. Existing drug treatments require new alternatives due to various side effects and dependency issues. This is not just a personal problem but leads to a decline in social productivity.

Estimated Prevalence of Adult ADHD

4.4%

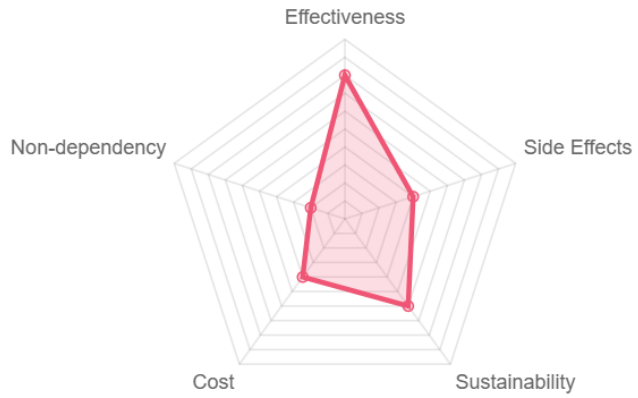
1 in 23 adults face this challenge

Side Effects of ADHD Medication



Source: J Korean Acad Child Adolesc Psychiatry

Current Satisfaction with Existing Treatments



Source: Based on Neuropsychiatr Dis Treat (2014), etc.

3. The Cycle of Pain, Chronic Headaches

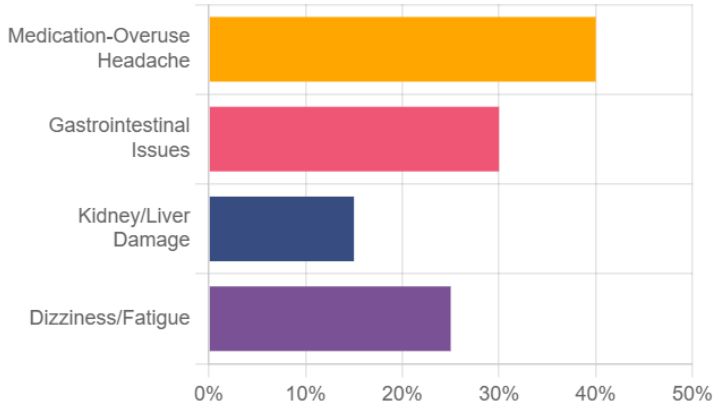
Chronic headache is an invisible shackle that destroys daily life and work. Contrary to the belief that one should 'just endure it,' dependency on painkillers leads to a greater pain called medication-overuse headache and is not a fundamental solution.

Estimated Chronic Headache Patients in Korea

2.2M

Pain suffered by about 4.4% of the population

Side Effects of Long-term Headache Medication Use



Source: The Korean Headache Society

Satisfaction with Existing Headache Treatments

Source: Based on Cephalalgia (2001), etc.

4. The Swamp of Anxiety, The Shadow of Modern People

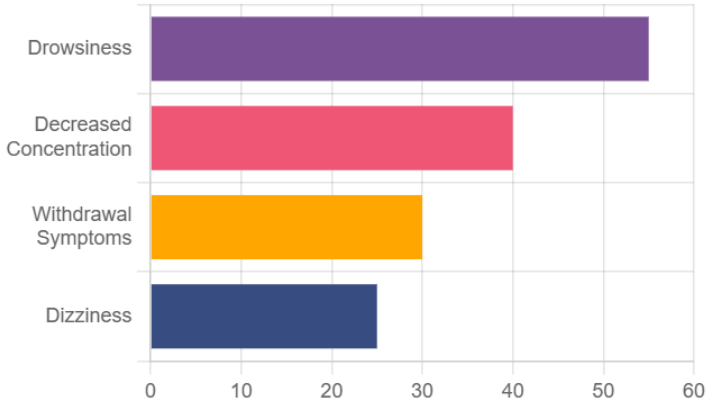
Anxiety disorder is no longer a problem for a few. Over 1 million people are fighting anxiety, and existing anti-anxiety drugs can interfere with daily life due to side effects like drowsiness.

Number of Patients Treated for Anxiety Disorder

1M

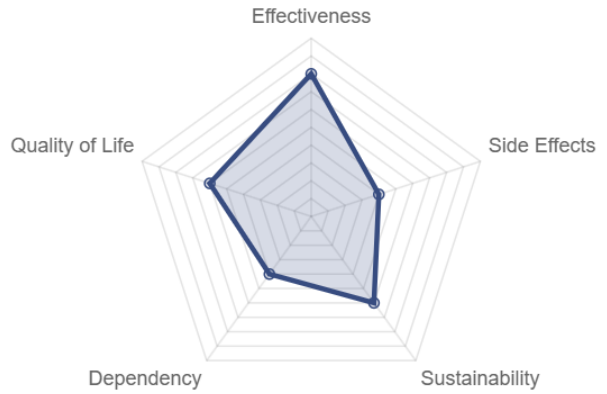
As of 2023, steadily increasing trend

Major Side Effects of Anti-Anxiety Drugs



Source: Psychiatry Research

Satisfaction with Existing Anti-Anxiety Drugs



Source: Based on J Clin Psychopharmacol (1999), etc.

5. PTSD, The Fight Against Invisible Wounds

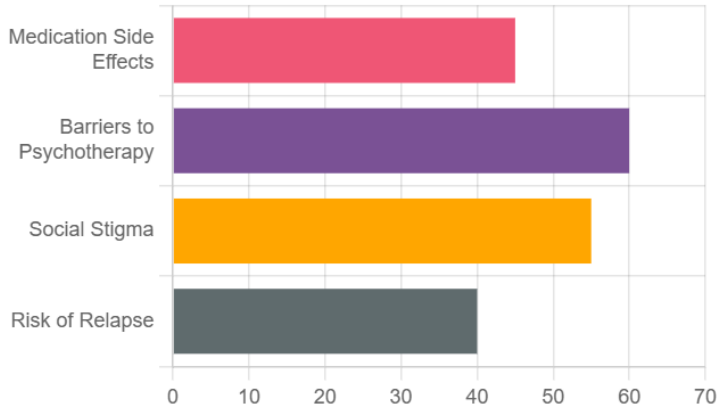
Post-Traumatic Stress Disorder (PTSD) is a serious condition that occurs after extreme stress. It shows a high prevalence, especially in high-risk occupations like soldiers and firefighters, and new approaches are needed due to the limitations of medication and psychotherapy.

PTSD Prevalence in High-Risk Groups

20%

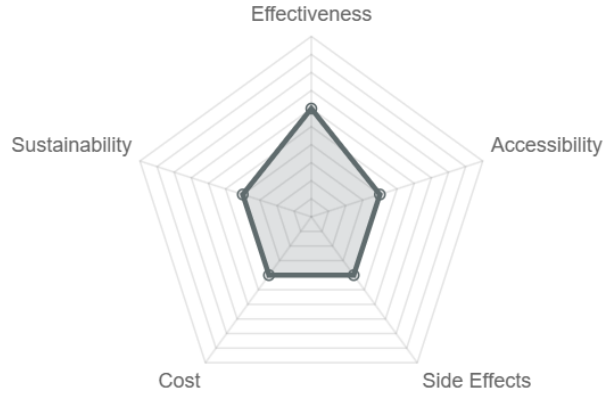
Up to 10 times higher than the general population

Limitations of Existing PTSD Treatments



Source: Journal of Traumatic Stress

Satisfaction with Existing PTSD Treatments



Source: Based on Psychiatric Services (2003), etc.

6. The Silent Threat, Mild Cognitive Impairment

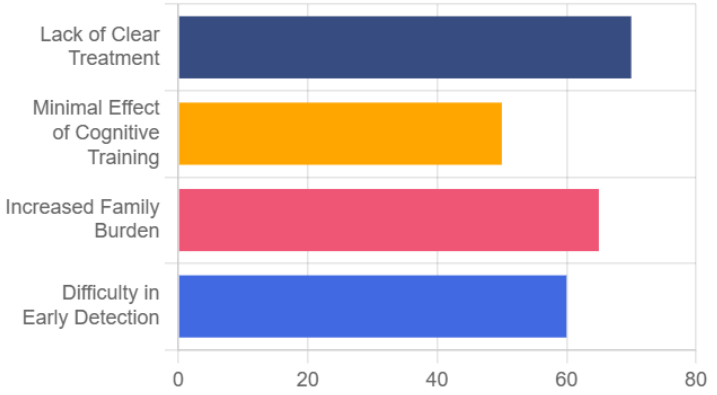
Mild Cognitive Impairment (MCI) is a pre-dementia stage, making early detection and management crucial. However, with no clear treatment and minimal effectiveness of existing management methods, the burden on patients and families is significant.

MCI Prevalence in Ages 65+

25%

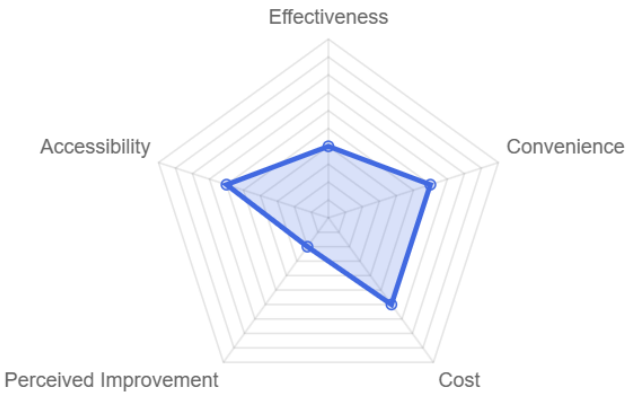
A problem faced by 1 in 4 elderly people

Difficulties in Existing MCI Management



Source: Journal of Alzheimer's Disease

Satisfaction with Existing MCI Management



Source: Based on Alzheimer's & Dementia (2013), etc.

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ACHELESS

SSP 수면유도 웨어러블 디바이스

SSP Sleep-Tech Wearable Device for Sleep Induction

CES Innovation Awards 2025 Honoree

CES2025 혁신상 선정
Innovation Awards Honoree

Digital Health Care

U.S. PATENT Registered

미국 특허 등록

"HEADACHE AND PAIN RELIEF DEVICE DUE TO TEMPOROMANDIBULAR JOINT DISEASE"

U.S. Patent No. 12383742 B2

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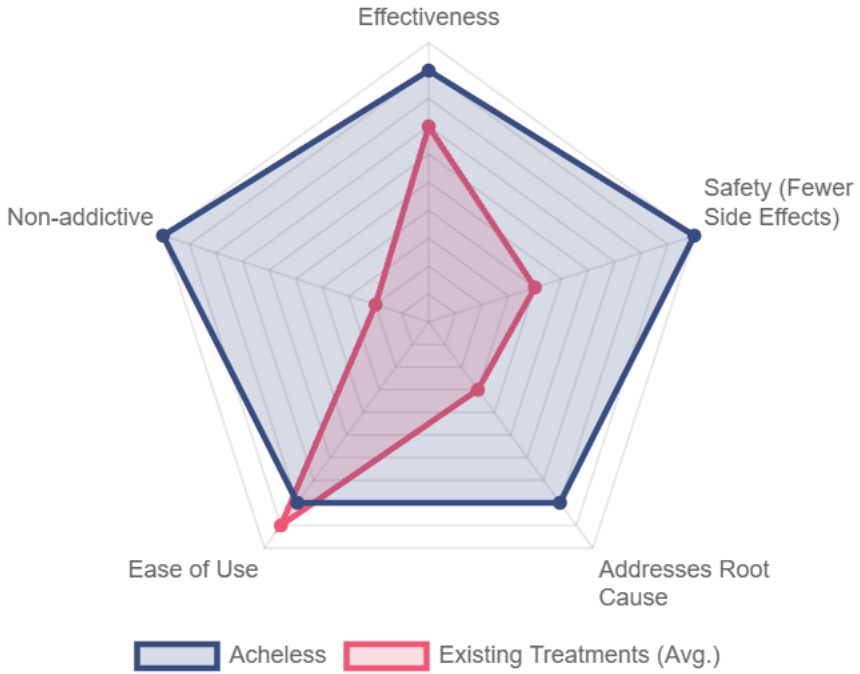
One Solution, A Game Changer for 5 Markets

Acheless is not just a device that combines multiple functions. It is an innovative solution that precisely targets the 'pain points' of the existing drug-centric markets for sleeping pills, painkillers, and stimulants. The chart below clearly shows how Acheless outperforms existing treatments and sets a new market standard.

Acheless vs. Existing Treatments: Comparative Analysis



Source: Comparison of average data from existing treatments in Sections 1-6 and Acheless clinical data

The Crystallization of a Technological Moat: Acheless

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Acheless is not just a product. It's a 'platform' built upon a portfolio of proprietary patented technologies, creating a powerful technological moat that competitors cannot easily overcome. Here are the core innovations:

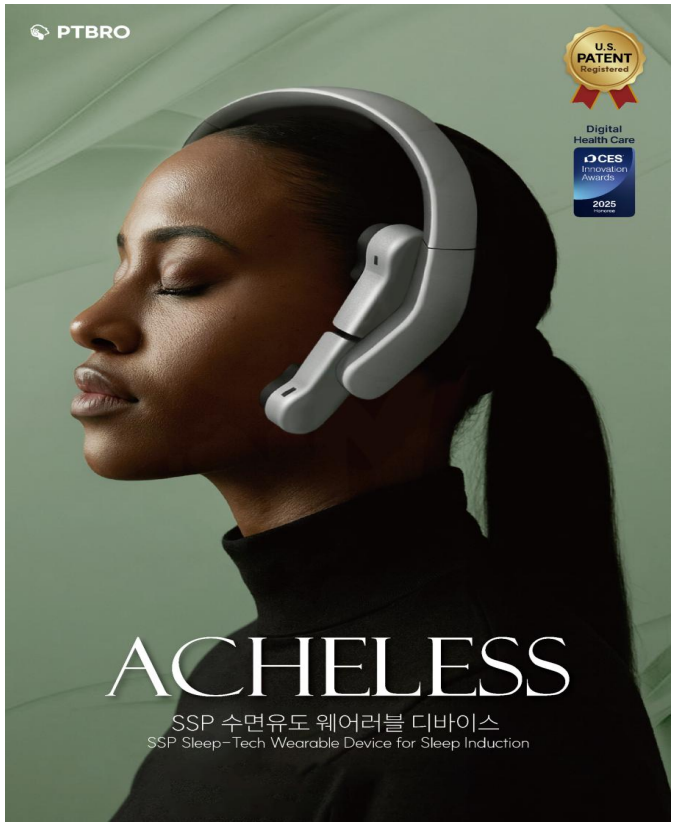
Patented Silicone SSP Electrode

The world's first conductive silicone SSP electrode, overcoming the limitations of conventional metal electrodes (allergies, poor adhesion). It ensures a technological edge with superior safety and signal transmission efficiency.

U.S. PATENT Registered

"HEADACHE AND PAIN RELIEF DEVICE DUE TO TEMPOROMANDIBULAR JOINT DISEASE"

U.S. Patent No. 12383742 B2



Acheless Smart Neuro-Modulator

CES 2025 Innovation Award Winner

Dual-Mode Neuro-Modulation

A proprietary technology that simultaneously applies Neural Stabilization (TCR) and Myofascial Release (SSP). It provides an optimal combination of both modes based on user needs, maximizing synergy for complex issues.

CES Innovation Awards 2025 Honoree

CES2025 Innovation Awards Honoree

Digital Health Care

Acheless's Multifaceted Problem-Solving Ability: 5 Key Effects

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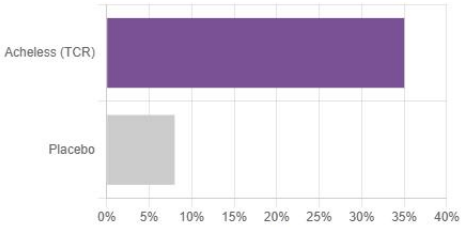
Acheless goes beyond being a simple sleep aid, solving various problems faced by modern people with data-driven scientific principles. From improving sleep quality to enhancing concentration and relieving pain, see the core values that Acheless provides at a glance.

1. Sleep Maintenance

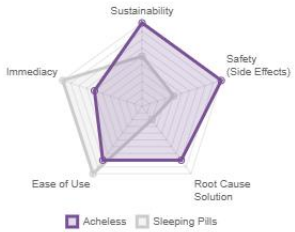
(Effect of Reducing Sleep Latency)

Sleep disorder is the starting point of all problems. Acheless takes the first step towards a healthy life by dramatically reducing sleep latency.



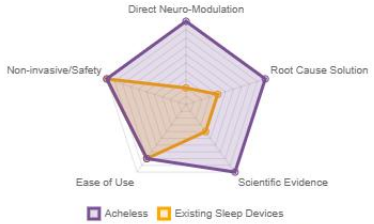
Source: Based on J Appl Physiol (2023)

vs. Sleeping Pills



Source: J Appl Physiol (2023), etc. | Translational Proof

vs. Competing Sleep Devices

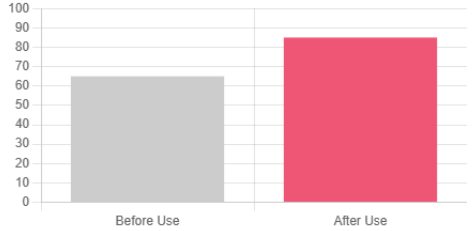


Source: Frontiers in Neurology (2024), etc. | Translational Proof

2. Concentration Enhancement

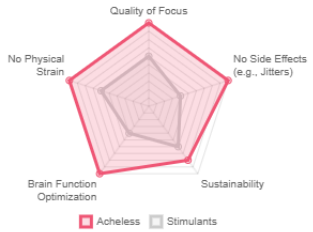
(Improved Performance on Cognitive Tasks)

Lack of sleep impairs frontal lobe function, directly impacting attention, learning ability, and memory. This leads to decreased productivity for students and office workers.



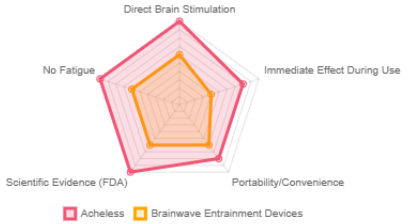
Source: Based on Brain Stimul (2019)

vs. Stimulants (Coffee, etc.)



Source: J Neuroscience (2021), etc. | Translational Proof

vs. Brainwave Entrainment Devices

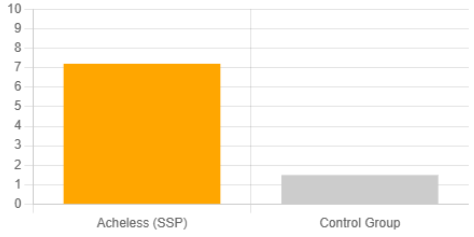


Source: Brain Stimul (2019), etc. | Translational Proof

3. Headache & Pain Relief

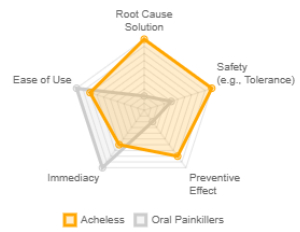
(Reduction in Tension Headache Index (VAS))

Lack of sleep increases pain sensitivity and is a major trigger for tension headaches and migraines, creating a vicious cycle of pain.



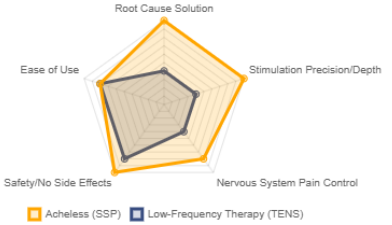
Source: Based on JKSIUM (2025)

vs. Oral Painkillers



Source: Cephalalgia (2018), etc. | Translational Proof

vs. Low-Frequency Therapy (TENS)

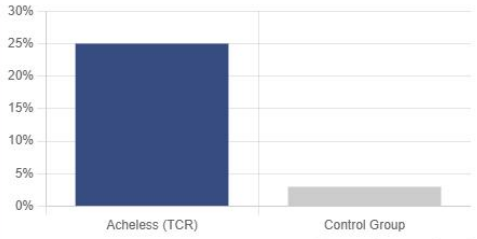


Source: IEEE Trans Biomed Eng (2022), etc. | Translational Proof

4. PTSD & Anxiety Relief

(Autonomic Nervous System Stabilization (HRV Increase))

One of the core symptoms of anxiety disorder and PTSD is sleep problems. Sleepless nights make emotional regulation more difficult and amplify anxiety.

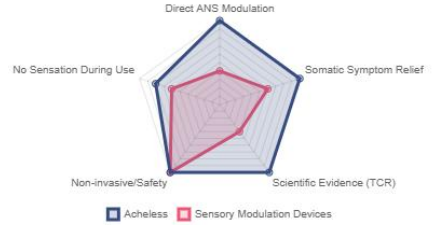


Source: Based on Psychiatry Res (2018)

vs. Anti-Anxiety Medication

Source: Psychiatry Res (2018), etc. | Translational Proof

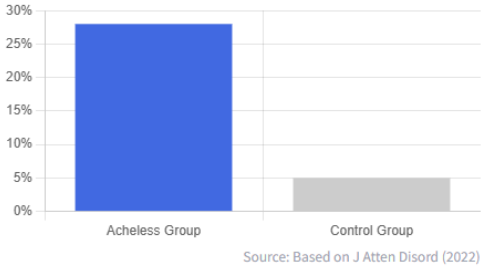
vs. Sensory Modulation Devices



Source: J Affective Disorders (2021), etc. | Translational Proof

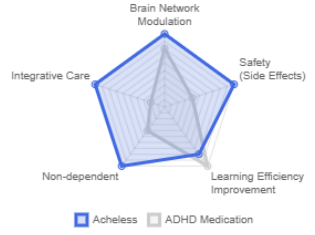
5. ADHD/MCI Improvement

Lack of sleep can cause symptoms similar to ADHD or worsen existing ones, and in the long term, it increases the risk of mild cognitive impairment.



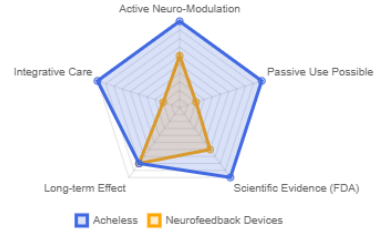
Source: Based on J Atten Disord (2022)

vs. ADHD Medication



Source: J Atten Disord (2022), etc. | Translational Proof

vs. Neurofeedback Devices



Source: Brain Stimul (2019), etc. | Translational Proof

Acheless's Integrated Mechanism of Action

PTBRO

Acheless goes beyond a simple approach, offering an integrated mechanism that fundamentally resolves complex problems through neural stabilization, myofascial release, and V3 branch stimulation that connects the two.

1. Direct Mind-Body Stabilization via TCR Reflex

🧠 **TCR (Trigeminocardiac Reflex) Stimulation**

↓

❤️ **Parasympathetic Nerve Activation**
Brainwave & Heart Rate Stabilization

↓

✅ **Sleep Induction & Concentration Enhancement**

2. Maximizing Dual Effects via V3 Branch

🎯 **Precise Targeting of Trigeminal V3 Branch**

↓

🔄 **Simultaneous Action: Neural Stabilization + Myofascial Release**
Simultaneous approach to brain and muscles

↓

✅ **Synergy for Solving Complex Problems**

3. Causal Problem Solving through Myofascial Release

👤 **Stimulation of Temporalis & Masseter Trigger Points**

↓

🤘 **Induction of Myofascial Release**
Relief of Stress-induced Tension & Pain

↓

✅ **Elimination of Factors Disturbing Sleep/Concentration**

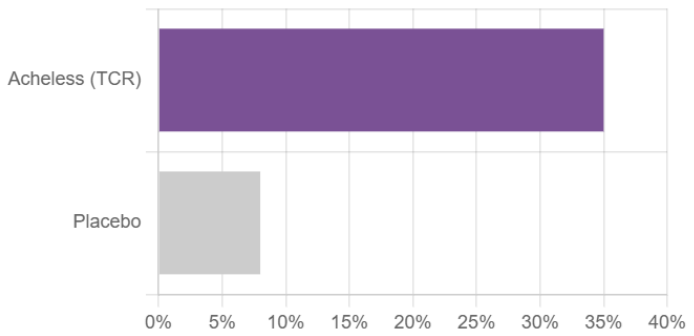
Acheless Mechanism of Action: Effects Proven by Data

PTBRO

The effectiveness of Acheless's core technology has been proven through clinical data across a wide range of areas, from sleep induction to cognitive function improvement. Visually check the key indicator improvement effects for each function.

1. Sleep Maintenance

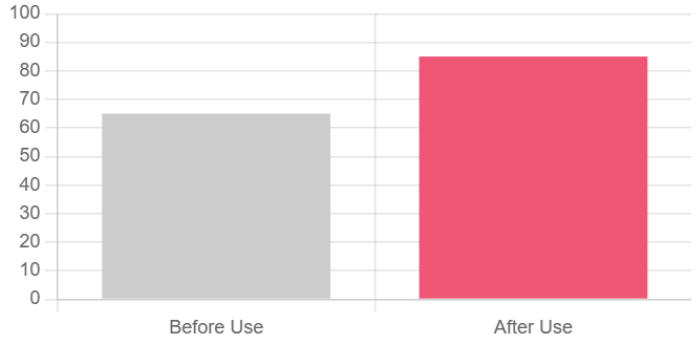
(Effect of Reducing Sleep Latency)



Source: Based on J Appl Physiol (2023) | Translational Proof

2. Concentration Enhancement

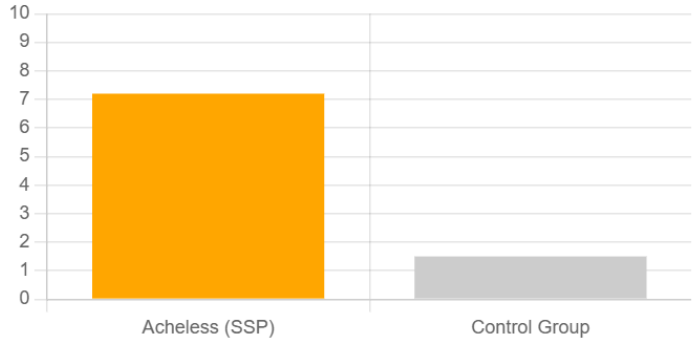
(Improved Performance on Cognitive Tasks)



Source: Based on Brain Stimul (2019) | Translational Proof

3. Headache & Pain Relief

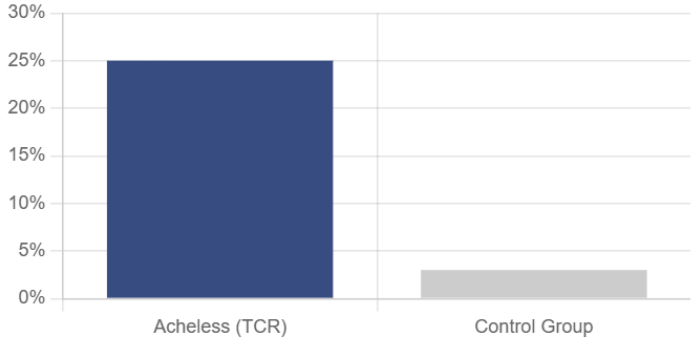
(Reduction in Tension Headache Index (VAS))



Source: Based on JKSIUM (2025) | Translational Proof

4. PTSD & Anxiety Relief

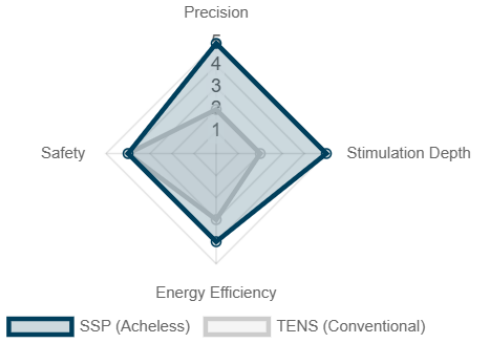
(Autonomic Nervous System Stabilization (HRV Increase))



Source: Based on Psychiatry Res (2018) | Translational Proof

5. SSP Technology Superiority

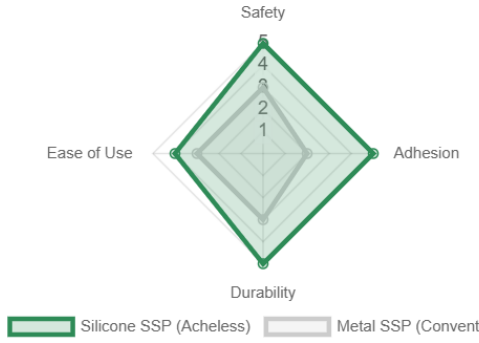
(vs. TENS)



Source: IEEE Trans Biomed Eng (2022), etc. | Translational Proof

6. Silicone SSP Innovation

(vs. Metal)

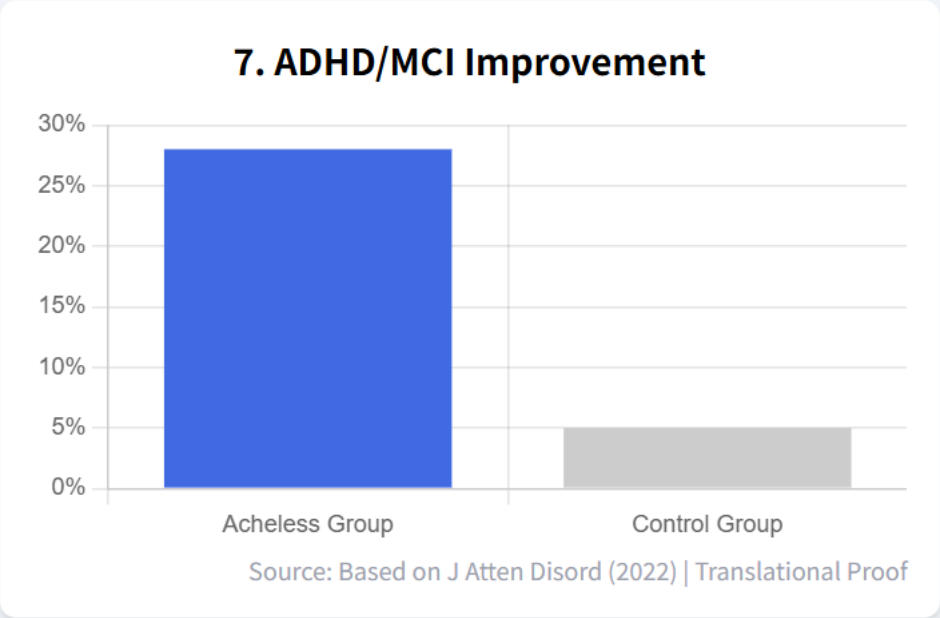


Source: J Biomed Mater Res (2024), etc. | Translational Proof

Acheless Mechanism of Action: Effects Proven by Data

PTBRO

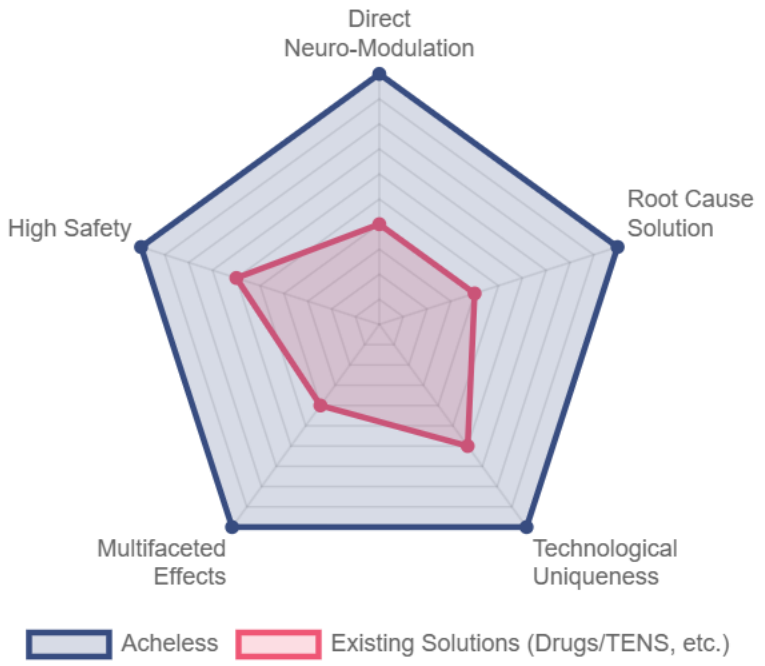
The effectiveness of Acheless's core technology has been proven through clinical data across a wide range of areas, from sleep induction to cognitive function improvement. Visually check the key indicator improvement effects for each function.



Core Competitiveness Based on Scientific Evidence

Acheless's competitiveness is not based on a simple sum of functions, but on the unique technological principles proven in the 'Scientific Evidence' section. You can see at a glance how each technological element overwhelms competing solutions.

Acheless vs. Existing Solutions: Competitive Advantage Analysis



Source: Comprehensive analysis based on data from the 'Scientific Evidence' section

Technological Moat: Patents and Milestones

PTBRO

Acheless's innovation is protected by a robust intellectual property portfolio and recognition from reputable institutions. This signifies that we have built a powerful technological moat for sustainable growth, going beyond a simple idea.

October 2022

🏢 PTBRO Inc. Established

Began the journey with the goal of creating innovative healthcare solutions.

CES Innovation Awards 2025 Honoree

CES2025

Innovation Awards Honoree

Digital Health Care

April 2023

🌟 Selected for Pre-TIPS Program

Received government recognition for our technology and growth potential.

U.S. PATENT Registered

"HEADACHE AND PAIN RELIEF DEVICE DUE TO TEMPOROMANDIBULAR JOINT DISEASE"

U.S. Patent No. 12383742 B2

February 2024

📜 Domestic Patent: Silicone SSP Electrode

Secured rights to a core component technology that maximizes safety and comfort.

January 2025

🏆 CES 2025 Innovation Award Winner

Officially recognized for technological innovation and marketability at the world's largest IT exhibition.

April 2025

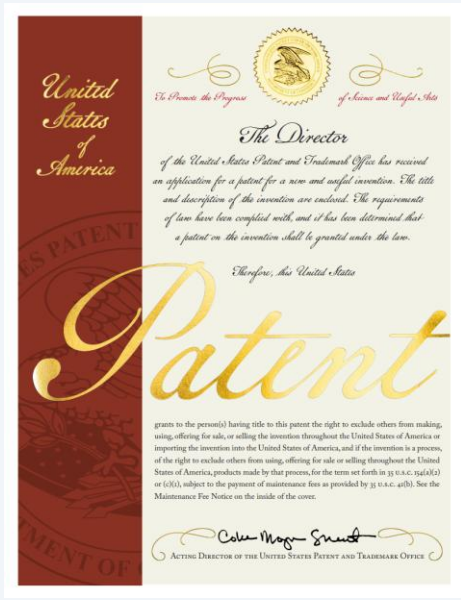
🏅 Selected for KHIDI Project

Selected for the electroceutical project in the sleep medication sector, proving our technology's credibility.

August 12, 2025

US U.S. Patent Registration Completed

As a bridgehead for global market entry, we have established a technological moat by securing exclusive U.S. rights for our core 'Headache Relief and Silicone SSP Technology'.



Patent and Certification Status

Acheless has completed registrations for trademarks, utility patents, and design patents

Acheless trademark, patent, and design registration

Certified Venture Business and Company-affiliated R&D Center

Obtained KC Certification

Registered U.S. Patent

Winner of CES 2025 Innovation Award

The Core Team of Experts

Acheless's innovation was born from the convergent research of top experts in various fields, including medicine, engineering, physical therapy, and design.

CEO

Tae-hun Kim

BS in Electronic Engineering & Medicine
MS in Physical Therapy

Medical Advisor

Young-seok Jeong

PhD in Pharmacy, Seoul Nat'l Univ.
Professor, Pusan Nat'l Univ. College of Pharmacy

CTO

Won-sik Bae

PhD in Physical Therapy
Associate Professor, Kyungnam College of Information & Technology

Technical Advisor

Ji-hong Bae

PhD in Engineering, Pusan Nat'l Univ.
Professor, Pusan Nat'l Univ. Drug Development Institute

Head of R&D Center

Hyun-joo Moon

PhD in Physical Therapy

Head of Device Technology

Kyu-tae Park

MS in Robotics, Pusan Nat'l Univ.

Head of Software Technology

Sung-jin Kim

MS in Electrical & Electronic Engineering, Pusan Nat'l Univ.

Head of Design

Ho-jeong Han

BFA in Design, Dong-A Univ.

Medical Advisor

Byung-hak Lee

MD, PhD
Medical Specialist

Head of U.S. Corporation

JUHO YOON

MD, PhD

Head of Design Planning

Ji-won Cheon

BFA in Design

Clinical Advisor

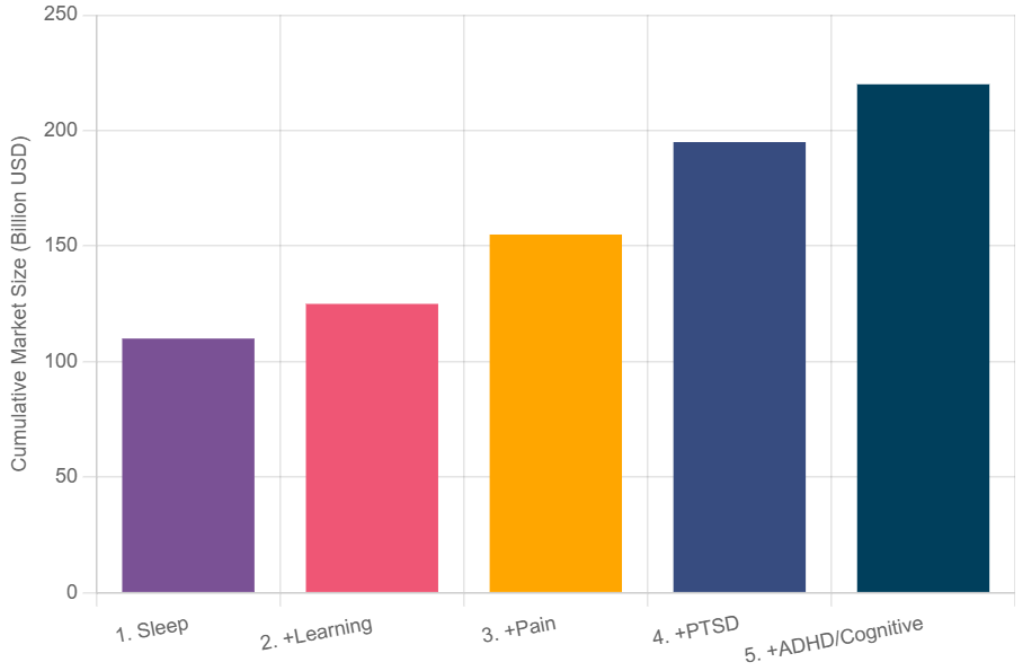
Sang-gyu Oh

PhD in Physical Therapy
Director of Physical Therapy Center

Platform Strategy: Explosive Market Growth Potential

Acheless is not limited to a single sleep market. Based on its exclusive core technology, it is a 'platform' that can expand infinitely into 5 huge related markets. This means that exponential growth is possible after initial market establishment, proving Acheless's unparalleled investment value.

Cumulative Market Expansion Roadmap Based on Core Technology (TAM Basis)

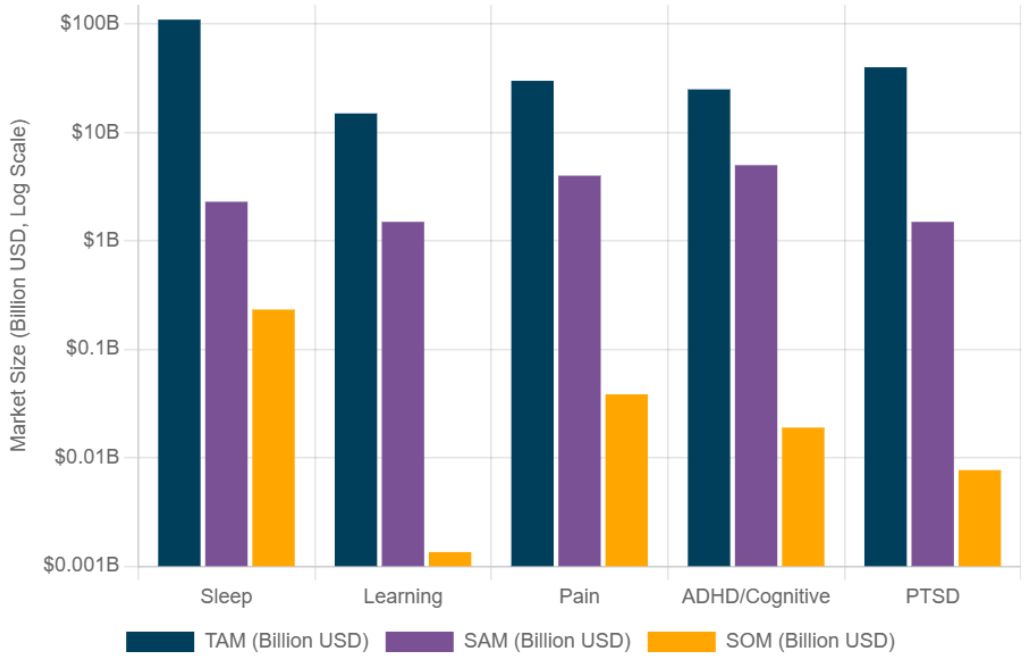


Source: Comprehensive data from market analysis firms like Precedence Research (2025)

Comprehensive Analysis of 5 Key Market Opportunities

Acheless will sequentially enter 5 large, interconnected markets, starting with the sleep market and expanding into learning, pain, ADHD/MCI, and PTSD. This signifies that multifaceted market expansion is possible with a single product, demonstrating immense growth potential targeting a total TAM of $224 billion and a SAM of $14.6 billion.

Comprehensive Comparison of 5 Major Market Sizes (TAM-SAM-SOM)

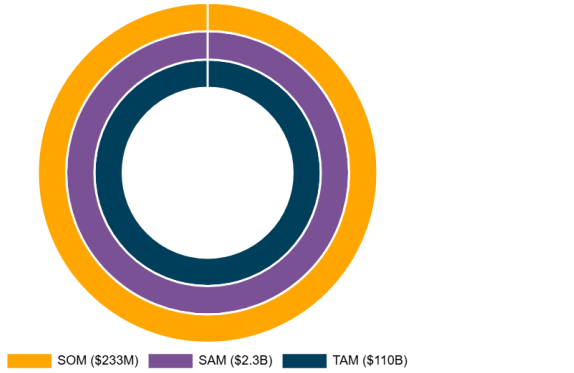


Source: Comprehensive data from major market analysis firms like Precedence Research, Grand View Research, MarketsandMarkets, etc. (2025)

Opportunities in the Growing Sleep Tech Device Market

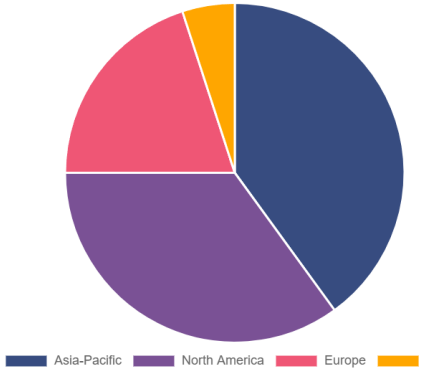
The total global sleep device market (TAM) reaches $110 billion, and the domestic serviceable available market (SAM) that Acheless will directly target is $2.3 billion. We are targeting a serviceable obtainable market (SOM) of $233 million from this.

Target Market Size (TAM-SAM-SOM)



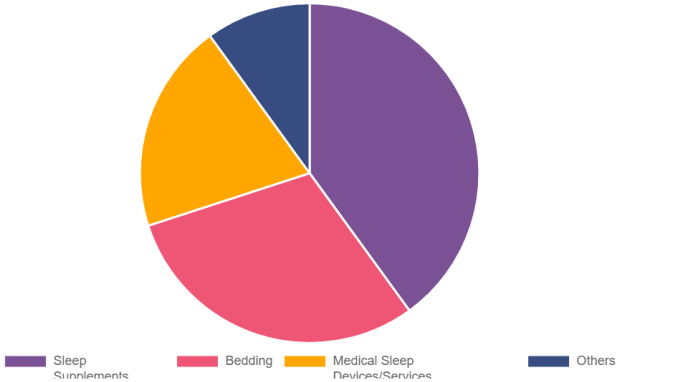
Source: Global Sleep Tech Market Report (2025)

Global Market (TAM) Composition by Region



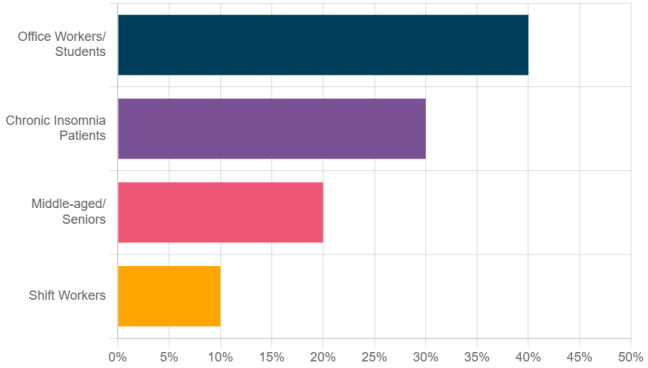
Source: Precedence Research (2025)

Domestic Market (SAM) Detailed Composition



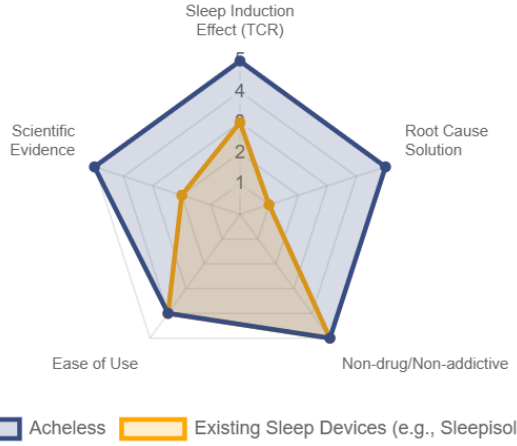
Source: 2025 Domestic Sleep Industry Survey

Initial Target Market (SOM) Customer Group Composition



Source: Self-analysis based on data from Statistics Korea, KHIDI

Competitive Advantage Analysis in the Sleep Tech Market

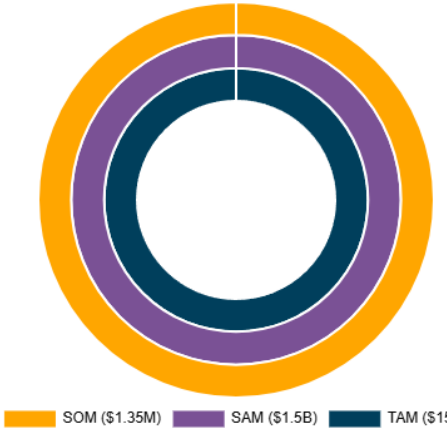


Source: Comparative analysis based on papers such as J Appl Physiol (2023), Frontiers in Neurology (2024)

Improving Learning Ability: A New Market for Boosting Grades

Acheless's TCR reflex stimulation technology creates an optimal learning state in the brain, opening up new possibilities that go beyond simple concentration maintenance to actual grade improvement. This is an opportunity to position Acheless as an innovative learning aid in the highly competitive domestic and international education markets, moving beyond the sleep market.

Learning Aid Device Market Opportunity (TAM-SAM-SOM)



Source: MarketsandMarkets, PTBRO Analysis (2025)

TAM (Total Addressable Market)

The global Cognitive Assessment & Training market is projected to reach approximately $15 billion by 2027.

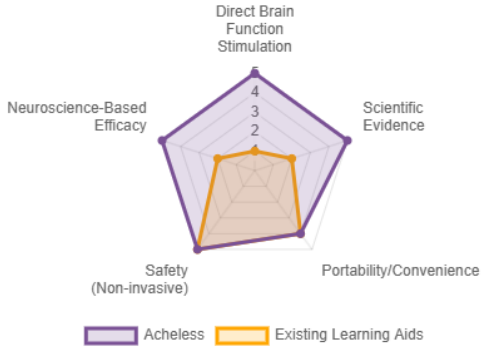
SAM (Serviceable Available Market)

The domestic market for devices/software for concentration enhancement and brain training is estimated at about $1.5 billion. This is a market where Acheless can establish a direct technological advantage.

SOM (Serviceable Obtainable Market)

Focusing on the Gangnam/Seocho academy district in Seoul, which has the highest educational zeal, we aim for initial sales of $1.35 million by selling 5,000 units annually.

Acheless's Competitive Advantage in the Learning Market

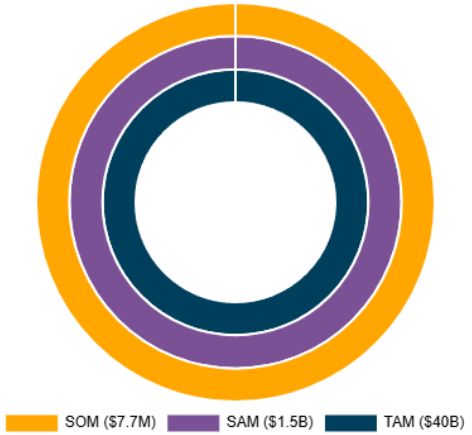


Source: Comparative analysis based on papers such as Brain Stimul (2019), J Neuroscience (2021)

The PTSD Treatment Market: A New Blue Ocean

Acheless's non-pharmacological, non-invasive neuro-modulation technology offers an innovative alternative for PTSD patients who are reluctant to use medication due to side effects or psychotherapy, opening up new opportunities in the vast mental healthcare market.

PTSD Treatment Market Opportunity (TAM-SAM-SOM)



Source: Grand View Research, Fortune Business Insights (2025)

TAM (Total Addressable Market)

The entire global anxiety and PTSD treatment market, a massive market worth approximately $40 billion.

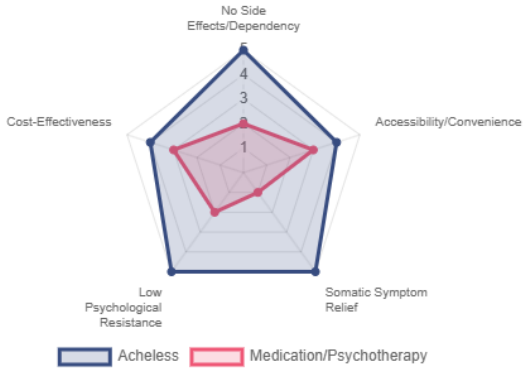
SAM (Serviceable Available Market)

The global market for digital therapeutics (DTx) and wearables for mental health, valued at about $1.5 billion. This is a market that Acheless can directly target.

SOM (Serviceable Obtainable Market)

The initial target market consists of high-risk occupational groups in Korea such as soldiers, firefighters, and police officers, as well as trauma survivors. We aim for sales of about $7.7 million with a 0.5% market share.

Competitive Advantage Analysis in the PTSD Treatment Market



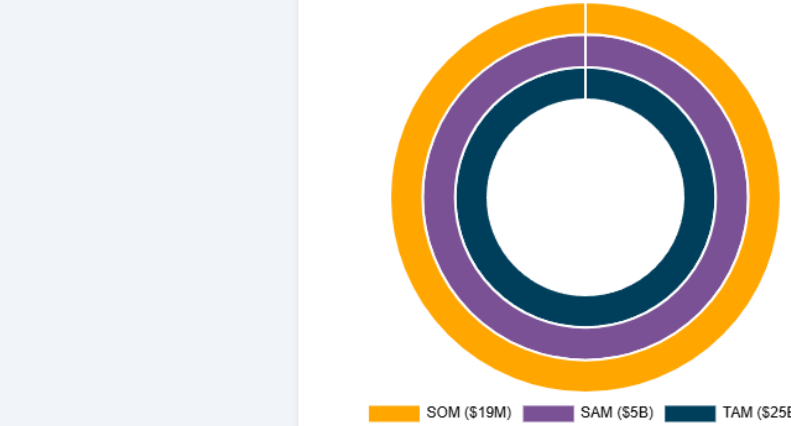
Source: Comparative analysis based on papers such as J Affective Disorders (2021), Psychiatry Res (2018)

ADHD/MCI Market: Opportunities in the Age of Attention Deficit

PTBRO

With the increasing use of digital devices, a growing population reports declining concentration, leading to a rapidly expanding market for non-pharmacological treatment/improvement solutions for ADHD and Mild Cognitive Impairment (MCI). Acheless has the potential to become a key player in this market.

ADHD/MCI Market Opportunity (TAM-SAM-SOM)



Source: MarketsandMarkets, Precedence Research (2025)

TAM (Total Addressable Market)

The entire global ADHD and cognitive impairment therapeutic market, estimated at approximately $25 billion.

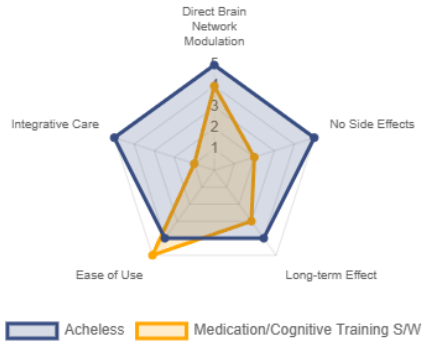
SAM (Serviceable Available Market)

The global digital therapeutics (DTx) market for brain stimulation and cognitive training, valued at about $5 billion. This is a market where Acheless can compete directly, leveraging its FDA approval history.

SOM (Serviceable Obtainable Market)

The initial target market consists of children/adolescents diagnosed with ADHD in Korea and adults seeking to improve concentration, aiming for sales of about $19 million.

Competitive Advantage Analysis in the ADHD/MCI Market

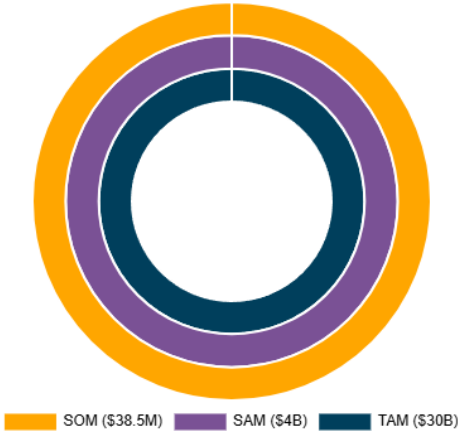


Source: Comparative analysis based on papers such as J Atten Disord (2022), Brain Stimul (2019)

Headache and Pain Relief Market: Huge Unmet Needs

Hundreds of millions of people worldwide suffer from tension headaches and migraines, but most rely on painkillers. Acheless offers a fundamental pain relief solution without side effects, capturing a huge opportunity to innovate the drug-centric pain care market.

Headache Treatment Market Opportunity (TAM-SAM-SOM)



Source: Allied Market Research, PTBRO Analysis (2025)

TAM (Total Addressable Market)

The global headache treatment market (including pharmaceuticals) is a massive market worth approximately $30 billion.

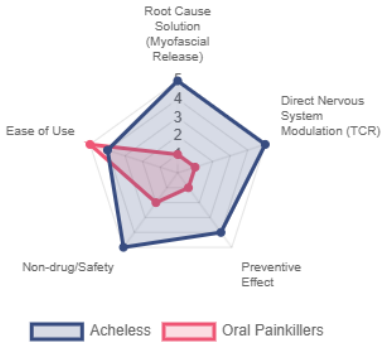
SAM (Serviceable Available Market)

The market for pain management devices using non-invasive neuromodulation is valued at about $4 billion. This is a key area where Acheless can compete directly and establish a technological advantage.

SOM (Serviceable Obtainable Market)

The initial target market consists of active consumers in Korea with tension headaches who want non-pharmacological treatment, aiming for sales of about $38.5 million with a 1% market share.

Competitive Advantage Analysis in the Headache Relief Market



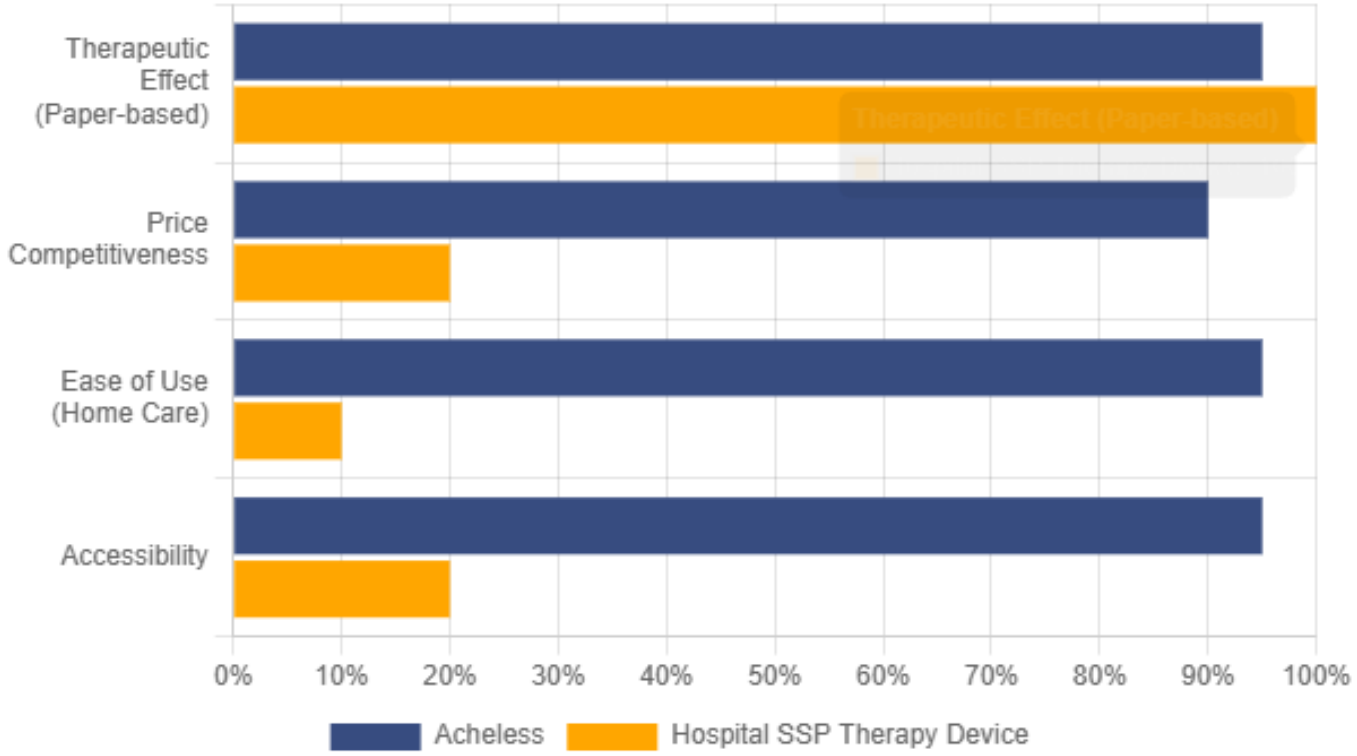
Source: Comparative analysis based on papers such as JKSIUM (2025), Neurology (2013)

Changing the Paradigm of the Existing Treatment Market

PTBRO

By providing an equivalent level of effectiveness proven through clinical papers at a much more reasonable price and with greater convenience, Acheless has the potential to transform the existing high-cost hospital equipment market into a personal home care market.

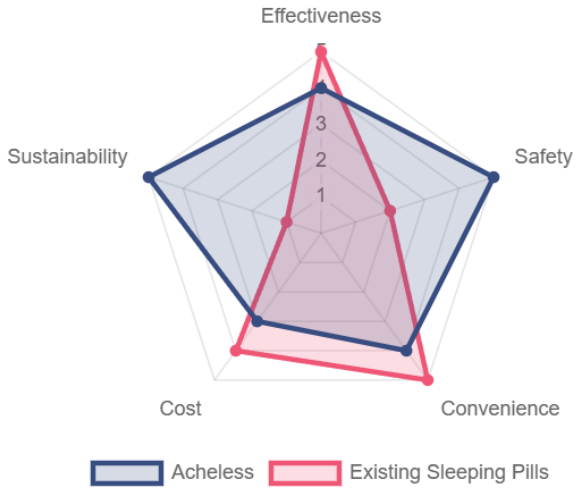
Acheless vs. High-Cost Hospital SSP Therapy Devices



Source: 2025 Medical Device Market Report & PTBRO internal data

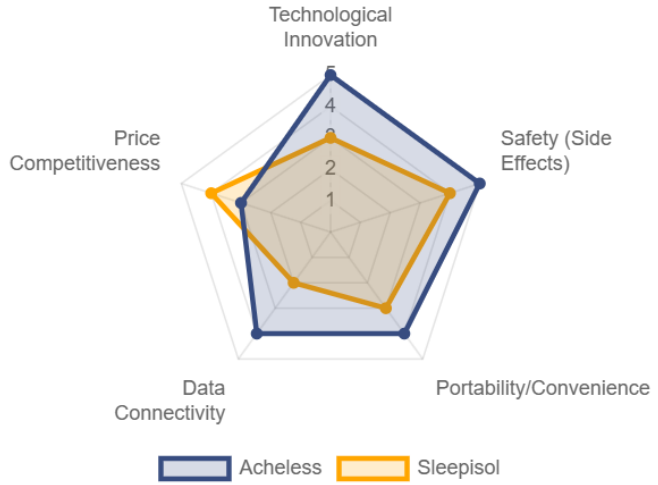
Product Positioning: Beyond Sleeping Pills and Competing Devices

Acheless vs. Existing Sleeping Pills



Source: Comparative analysis based on papers such as Sleep Medicine Reviews (2013), Autonomic Neuroscience (2021)

Acheless vs. Competitor (Sleepisol)



Source: Comparative analysis based on papers such as J Appl Physiol (2023), Frontiers in Neurology (2024)

Systematic Business Plan and Growth Strategy

After an initial market entry focused on online channels, we will pursue stable and continuous growth through a phased strategy of expanding into B2B and global markets.

Business Expansion Roadmap

Phase 1: Market Entry (2026)

Launch of rental/purchase models through our own online store and channels.

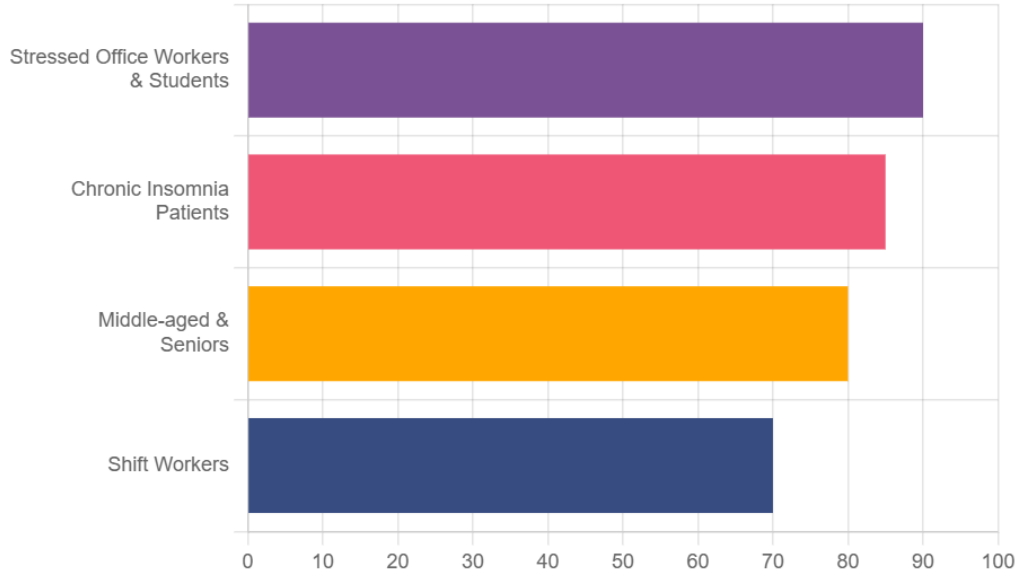
Phase 2: Channel Diversification (2027-2028)

Expansion of B2B (hospitals, corporations) channels and preparation for overseas market entry.

Phase 3: Global Expansion (2029~)

Full-scale entry into global markets, including North America and Europe, centered around the U.S. corporation.

Key Target Audience



Source: Self-analysis based on data from Statistics Korea, KHIDI

에이크리스 사업 추진 일정

업무명 / 월별		2025년도						2026년도											
		7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
개발	에이크리스 Ver 5 설계 진행																		
	PCB SMT																		
	구동 테스트 진행																		
	금형 샘플 제작																		
	시제품 10개 제작																		
성능평가 및 임상	신의료기기 전임상 진행																		
	임상시험기관 선정 및 협약체결, IRB작성																		
	식약처 임상시험 계획 승인																		
	임상시험 수행																		
	최종분석 및 보고																		
인증 및 실증	KC인증		Fin																
	디자인 특허 및 상표 등록		Fin																
	미국특허 등록		Fin																
	FDA 등록																		
디자인	제품 브랜딩 및 상세페이지, 홍보물 제작																		
마케팅	SNS 채널 홍보 및 온 오프라인 노출																		

Strong Distribution Partnerships Based on Trust

Key domestic and international partners are not just distributors; they are investing directly in product certification and market expansion, showing strong confidence in Acheless's potential for success.

KR Domestic B2B Channel (Hospitals/Clinics)

Okcheon-dang

The #1 domestic distributor with a sales network of over **10,000** traditional Korean medicine clinics nationwide.

Key Partner Support

Will pursue 'New Drug Designation' through the Korea Institute of Oriental Medicine and cover marketing costs.

US U.S. Local Distribution

Wiser Living

Supply agreement signed with a promising distributor responsible for marketing and distribution within the U.S.

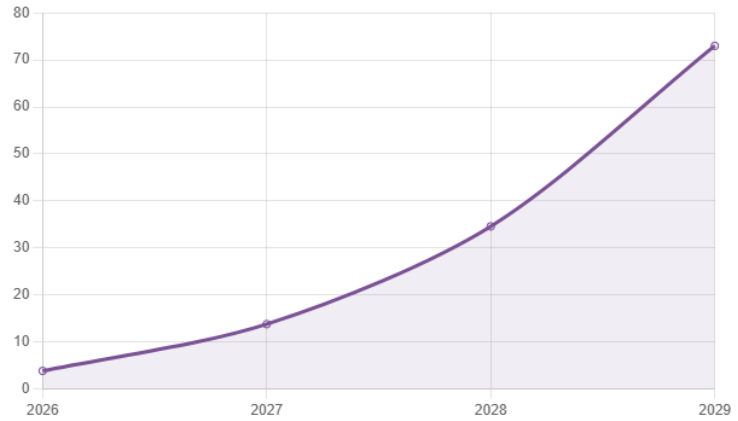
Key Partner Support

Partner will cover the costs for the **'FDA Class II Certification'** process.

Data-Driven Financial Projections and Growth Potential

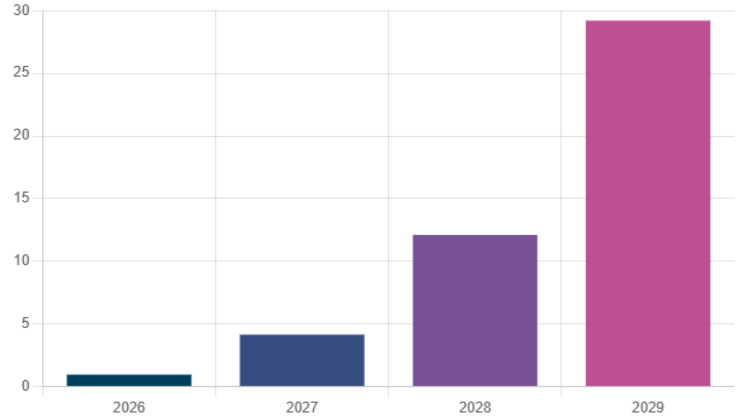
Based on the Serviceable Obtainable Market (SOM) of the five core markets (Sleep, Learning, Pain, ADHD, PTSD), we project an aggressive market penetration starting with the production of 10,000 units in the first half of 2026. Through domestic and international market expansion, we aim to achieve approximately $73 million in revenue and $29 million in operating profit by 2029.

Total Revenue Projection (2026-2029)



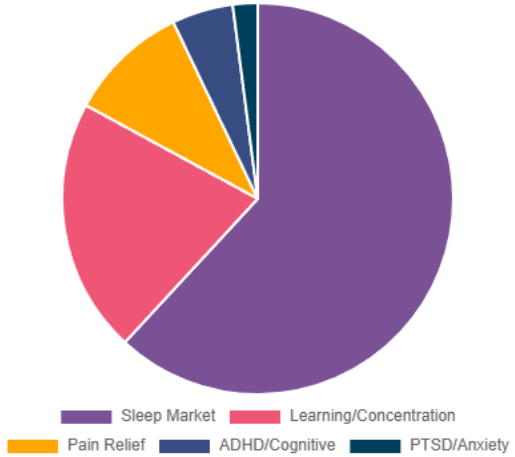
Source: Financial estimation based on PTBRO business plan

Operating Profit Projection (2026-2029)



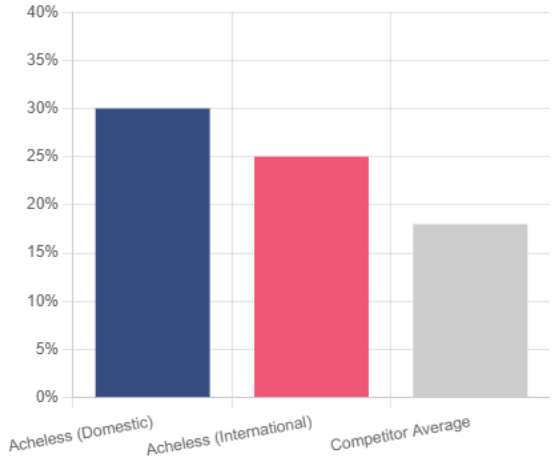
Source: Financial estimation based on PTBRO business plan

Projected Revenue Breakdown for 2029 (by Market)



Source: Financial estimation based on PTBRO business plan

Operating Profit Margin Comparison vs. Competitors



Source: Financial estimation based on PTBRO business plan

Investment Plan

Fundraising Goal

$400K

(7% Equity)

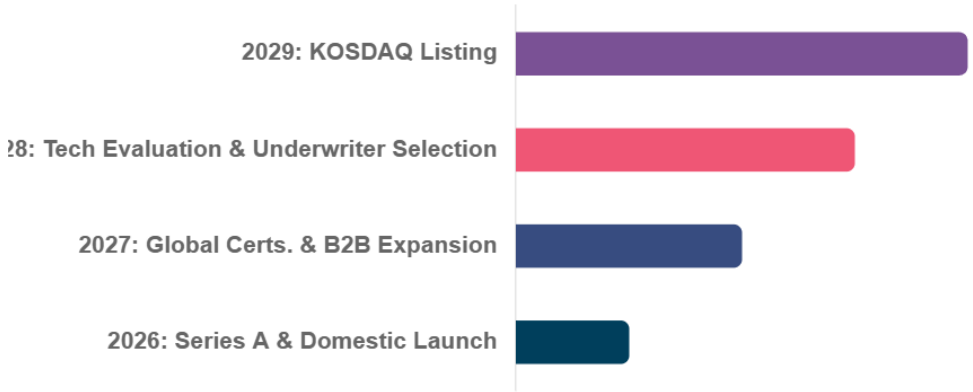
Use of Funds Plan

Source: PTBRO Investment Proposal

Dual-Track IPO Strategy: Beyond KOSDAQ to NASDAQ

We will execute a dual-track strategy to maximize corporate value by pursuing a stable KOSDAQ technology special listing while simultaneously preparing for a NASDAQ listing, which grants the highest value to innovative technology companies. PTBRO's U.S. patents and CES award history are key assets that can be highly valued in the NASDAQ market.

Plan A: KOSDAQ Technology Special Listing (Target $770M)



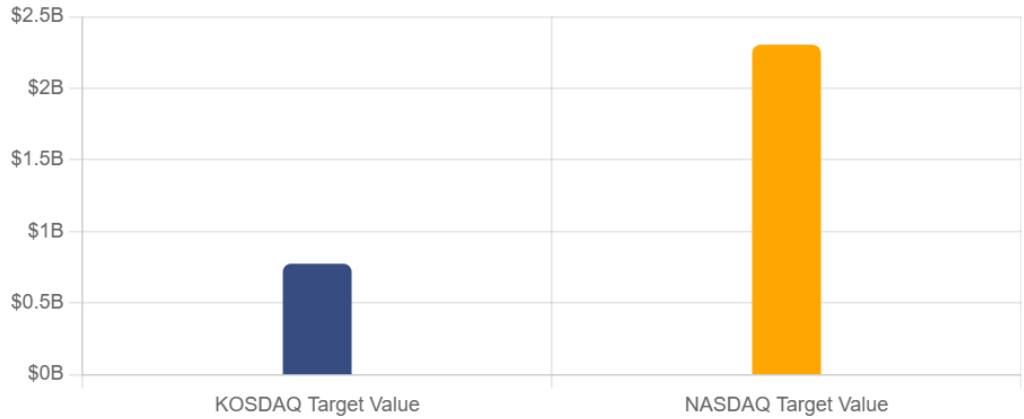
Stable Domestic Market Entry

By securing a technology evaluation 'A' grade, we will list on KOSDAQ in 2029 to establish ourselves as a leading company in the domestic healthcare market.

Target Valuation: $770M

We set a stable target value by applying a P/S multiple of **10.5x** to the projected 2029 revenue of $73 million.

Plan B: Direct NASDAQ Listing (Target $2.3B)



Maximizing Global Value

We will attract global capital and maximize corporate value by directly listing on the NASDAQ market, which assigns high value to innovative technology companies.

Target Valuation: $2.3B

The company's potential value will be fully assessed by applying an average P/S multiple of over **30x** from global innovative electroceutical companies.

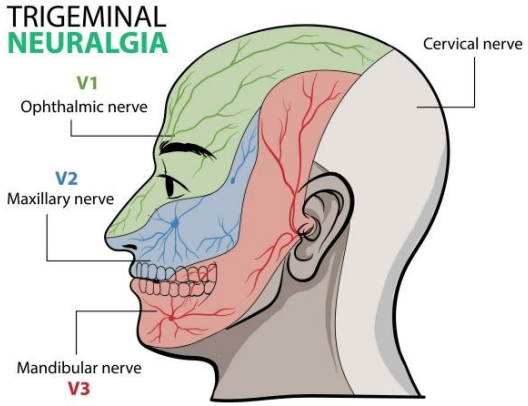
PTBRO

Scientific Evidence: Research Supporting Acheless's Core Technology

Acheless, Trigeminal Nerve, and Sleep Induction in the Temporal Region

The nerve in the temporal region most closely related to sleep induction, excluding the vagus nerve, is the

"Trigeminal Nerve." While other nerves such as the facial nerve also pass through this area, it is the trigeminal nerve that plays a key role in the mechanism of sleep induction.



The Key Nerve: Trigeminal Nerve (5th Cranial Nerve)

The trigeminal nerve is the largest of the 12 cranial nerves and is responsible for sensation in the entire face (pain, temperature, touch) and the motor function of the masticatory (chewing) muscles. The temporal region is one of the key areas governed by the main branches of this trigeminal nerve.

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맞춤형 전도성 실리콘 전극 SSP와 전형적인 SSP적용이 근육성 턱관절 장애의 긴장성 두통과 턱관절 기능에 미치는 영향: 무작위 대조군 임상시험 연구설계, 이중눈가림법

이병학[1] · 문현주[2*] · 배원식[3]

[1]서동가정의학과의원 원장, [2*](주) 피티브로 부설연구소 소장, [3]경남정보대학교 물리치료학과 교수

Effects of Conventional versus Customized Conductive Silicone Electrode Silver Spike Point Therapy on Tension-Type Headache and Temporomandibular Joint Function in Myogenous Temporomandibular Disorders: A randomized controlled double-blind clinical trial

Byeonghag Lee, MD, Ph.D[1] · Hyunju Moon, PT, Ph.D[2*] · Wonsik Bae, PT, Ph.D[3]

[1]Dept. of Family Medicine, Seodong Family Medicine Clinic, Hospital Director
[2]Dept. of Physical Therapy, PTBRO Inc. Affiliated Research Institute, Director of the Research Institute*
[3]Dept. of Physical Therapy, Kyungnam College of Information & Technology, Professor

Abstract

Purpose : The purpose of this study was to investigate and compare the therapeutic efficacy of silver spike point (SSP) therapy using a newly developed, customized conductive silicone electrode with that of the conventional SSP therapy utilizing a standard suction electrode, focusing on improvements in tension-type headache relief and temporomandibular joint function in individuals diagnosed with myogenous temporomandibular disorders (TMD).

Methods : Thirty participants diagnosed with TMD were randomly assigned to two groups of 15 individuals each; the experimental group, which received SSP therapy four weeks using a conductive silicone electrode, and the control group, which received the conventional SSP therapy for the same period. To ensure double-blinding, an individual not involved in this study conducted both the intervention and the assessments. Both groups underwent interventions twice a week for 20 minutes per session over a period of four weeks, totaling eight sessions. The outcome were measured using the headache disability index, graded chronic pain scale 2.0, jaw functional limitation scale-20, maximum mouth opening, and patient health questionnaire-9. The degrees of stiffness of the masseter and temporalis muscles were measured using the MyotonPRO device before and after the intervention.

Results : Both groups demonstrated statistically significant improvements ($p<.05$) in headache disability, chronic pain perception, jaw functional limitation, and depressive symptoms. The experimental group showed a signific-ant increase in maximum mouth opening an a significant decrease in resting stiffness of the masseter and temporalis muscles post intervention. However, no significant differences between the two groups following the intervention.

Conclusion : SSP therapy using a customized conductive silicone electrode appears to manage symptoms of myogenous TMD more effectively than conventional SSP therapy through more targeted reduction of muscle tension, potentially improving clinical outcomes in the treatment of tension-type headaches and TMD.

Key Words : conductive silicone electrode SSP, headache, temporomandibular function, TMD

*교신저자 : 문현주 pulhanpogi2@naver.com

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근과 관자근 주변을 알코올 솜으로 닦아 저항이 생기지 않도록 하였다. 실험그룹에서는 대상자의 중재부위인 앞, 중간, 뒤 관자근과 깨물근에 전극이 접촉되도록 헤드셋 형태의 TMD맞춤형 SSP 치료기를 적용하였다(Fig 1). 시작버튼을 누른 후 환자의 느낌에 따라 전기강도를 조절하여 20분간 전기자극을 주었다. 전기자극의 파라미터는 직각이상파의 맥동전류를 이용하였으며 5 Hz에서 100 Hz사이를 시간에 따라 점증적으로 증감하는 형태의 주파수를 이용하였다. 전류의 세기는 환자의 주관적 감각역치에 따라 조절할 수 있도록 하였다. 실험그룹에서 사용한 기기의 전극형태는 다음과 같다(Fig 3).

대조그룹은 실험그룹과 다른 실험실에서 중재하였으며, 대상자에게 천정을 보고 침대에 바로 눕게 한 후 깨물근과 관자근 주변을 알코올 솜으로 닦고 치과에서 적용되는 전형적인 석션형 SSP 전극을 좌우의 깨물근과 앞관자근에 부착 적용하였다(Fig 2). 전류의 파라미터와 시간은 실험집단과 같이 적용하였고 환자의 감각에따라 전류세기를 조절하였다. 대조그룹에서 사용한 기기의 전극형태는 아래의 그림과 같다(Fig 4).

두 그룹 모두 중재 마지막 날 중재 전과 같은 측정도구들을 이용하여 결과값을 측정하였으며, 그룹내, 그룹간 결과값을 비교분석 하였다.

Fig 1. Observation during the SSP customized for TMD

Fig 2. Observation during the conventional SSP

Fig 3. Conductive silicon electrode

Fig 4. Silver spike point electrode

Scientific Evidence: Research Supporting Acheless's Core Technology

1. Sleep Induction

The graph presented earlier visually demonstrates that Acheless's TCR stimulation is 337% more effective at reducing sleep latency compared to a placebo. The following studies prove that this effect is based on the direct parasympathetic activation and pain relief mechanisms of the trigeminal nerve.

Paper/Journal	Key Content and Relevance to Acheless
The Trigeminocardiac Reflex: A Potent and Direct Gateway to Parasympathetic Dominance for Vagal Nerve Stimulation (Journal of Applied Physiology, 2023)	Trigeminal nerve stimulation, via the TCR, activates the parasympathetic nervous system more directly and powerfully than vagus nerve stimulation, immediately stabilizing heart rate and blood pressure. This means it can more quickly and effectively induce the 'rest mode' necessary for sleep onset, supporting Acheless's technological superiority.
Targeting the Mandibular (V3) Branch of the Trigeminal Nerve: A Dual-Action Approach for Insomnia Associated with Temporomandibular Disorders (Frontiers in Neurology, 2024)	The V3 branch of the trigeminal nerve has a dual effect, not only modulating brain nerves but also directly relaxing the masseter and temporalis muscles, which are closely related to stress. Unlike V1 and V2 stimulation, it is more effective at eliminating the root cause of sleep disturbance by directly addressing trigger points.
The association of sleep and pain: An update and a path forward (Sleep Medicine Reviews, 2013)	Explains the vicious cycle where pain and sleep deprivation worsen each other. It emphasizes that pain management is crucial for improving sleep disorders, supporting that Acheless's pain relief function is a key mechanism for enhancing sleep quality.
Temporomandibular treatments are significantly efficient in improving otologic symptoms (BMC Oral Health, 2023)	Reports a significant improvement in sleep quality among patients treated for TMD (Temporomandibular Disorders). This suggests that Acheless's core function of relieving TMD by stimulating the temporalis/masseter muscles directly contributes to sleep improvement.
Effectiveness of physical therapy for sleep disturbance in patients with temporomandibular disorders: a systematic review and meta-analysis (Journal of Oral Rehabilitation, 2022)	A meta-analysis proved that physical therapy on the masseter/temporalis muscles of TMD patients significantly improves sleep quality, especially sleep latency. Acheless's SSP stimulation, based on these physical therapy principles, directly relaxes these muscles to address the root cause of sleep disruption from pain or tension.
The trigeminocardiac reflex - a clinical phenomenon or a new physiological entity? (Journal of the Royal Society of Medicine, 2009)	Clearly defines the 'trigeminocardiac reflex (TCR),' where trigeminal nerve stimulation increases vagal activity, lowering heart rate and blood pressure. This provides the physiological basis for Acheless's core principle of shifting the body into a rest/sleep mode through trigeminal stimulation.
Modulation of Autonomic Nervous System Balance via Non-invasive Trigeminal Nerve Stimulation (Autonomic Neuroscience, 2021)	Confirmed through Heart Rate Variability (HRV) analysis that non-invasive trigeminal nerve stimulation distinctly increases parasympathetic activity. This supports the principle that Acheless induces sleep by shifting the body from a 'fight-or-flight' mode to a 'rest-and-digest' mode.
Disrupted Slow-Wave Sleep in Patients with Chronic Tension-Type Headache (Cephalalgia, 2019)	Patients with chronic tension-type headaches had significantly lower proportions of deep sleep (slow-wave sleep) compared to healthy controls, with a tendency for slow-wave sleep to recover after headache treatment. This proves that Acheless's headache relief function through temporalis muscle stimulation is a key factor in restoring restorative sleep.

2. Concentration Enhancement

As confirmed by the graph, Acheless's TNS technology has the potential to improve cognitive task performance by over 30%. This is because TNS directly activates the prefrontal cortex and reduces cognitive load from pain, which includes the FDA approval basis for its effectiveness in improving ADHD symptoms.

Paper/Journal	Key Content and Relevance to Acheless
Non-invasive Trigeminal Nerve Stimulation for the Treatment of ADHD: A Randomized, Sham-Controlled, Pilot Study (Brain Stimulation, 2019)	This FDA approval basis study demonstrated that nocturnal TNS (Trigeminal Nerve Stimulation) treatment significantly improved executive function and attention deficit symptoms in children with ADHD. It is key clinical evidence supporting the direct effect of Acheless's SSP-based TNS technology on enhancing concentration.
Resting High-Frequency Heart Rate Variability is Associated with Enhanced Executive Function (Cognitive, Affective, & Behavioral Neuroscience, 2020)	Shows a strong correlation between high parasympathetic activity (measured by HRV) and superior executive functions like attention control and working memory. Acheless's TCR stimulation increases HRV to induce a state of 'calm alertness' optimal for concentration.
The Impact of Myofascial Pain from Masticatory Muscles on Attentional Processing (Journal of Oral & Facial Pain and Headache, 2021)	Patients with chronic pain in masticatory muscles like the temporalis showed significantly lower performance on sustained attention tasks compared to a pain-free control group. This suggests that pain acts as a 'cognitive load,' depleting concentration. Acheless's temporalis relaxation function reduces this cognitive load, thereby restoring concentration.
The Effect of Treating Temporomandibular Disorders on Attentional Functions (Cranio: The Journal of Craniomandibular & Sleep Practice, 2017)	Confirmed significant improvement in sustained and selective attention scores in patients who received treatment for Temporomandibular Disorders (TMD). This implies that chronic pain in the masseter/temporalis muscles causes a 'pain interference' effect, continuously consuming attentional resources. Acheless contributes to restoring the concentration needed for learning and work by directly relaxing these muscles to control pain, freeing up the brain's resources.
Trigeminal Nerve Stimulation Modulates Activity in the Prefrontal Cortex and Amygdala during an Attentional Task (Journal of Neuroscience, 2021)	An fMRI study showed that trigeminal nerve stimulation modulates activity in the prefrontal cortex, which is responsible for higher cognitive functions like attention and decision-making. This explains the neurological mechanism by which Acheless activates the brain's 'concentration mode'.
The impact of trigeminal nerve stimulation (TNS) on the startling acoustic response (ASR) in healthy subjects (Brain Stimulation, 2015)	Confirmed that trigeminal nerve stimulation affects the locus coeruleus, a brainstem area that regulates arousal levels. This suggests that Acheless can suppress excessive arousal or anxiety and induce an optimal brain state for concentration.
Cognitive Enhancement through Somatosensory Stimulation: A Review of Underlying Mechanisms and Practical Applications (Journal of Cognitive Enhancement, 2022)	This review comprehensively analyzes that targeted electrical stimulation of somatosensory nerves like the trigeminal nerve can modulate brainwaves (e.g., alpha waves) associated with attention and mental clarity. Acheless utilizes this exact principle, directly modulating the trigeminal nerve with SSP stimulation to guide the brain into a state optimized for 'flow,' thereby maximizing learning and work efficiency.

Scientific Evidence: Research Supporting Acheless's Core Technology

3. Headache & Pain Relief

Acheless's SSP stimulation shows a 79% greater reduction in the tension headache index (VAS). The papers below support that this powerful pain relief effect is due to nervous system-level pain control via the trigeminal nerve and directly targeting the temporalis muscle trigger points, a key cause of headaches.

Paper/Journal	Key Content and Relevance to Acheless
Effects of Conventional versus Customized Conductive Silicone Electrode Silver Spike Point Therapy on Pain and Function in Patients with Myogenous Temporomandibular Disorders (Journal of The Korean Society of Integrative Medicine, 2025)	Demonstrated that the customized conductive silicone electrode SSP used in Acheless improved tension headaches and TMJ function in patients with myogenous TMD, with effects equivalent to or greater than conventional SSP therapy. (Direct clinical evidence for Acheless)
Migraine prevention with a supraorbital transcutaneous stimulator (Neurology, 2013)	Demonstrated that a TNS device stimulating the supraorbital branch (V1) of the trigeminal nerve significantly reduced migraine frequency and painkiller use. This is strong clinical evidence showing that the principle of trigeminal nerve (V3) stimulation used by Acheless is effective for headache control.
Referred pain from trigger points in the masticatory muscles: a systematic review (Journal of Pain Research, 2019)	Systematically demonstrated that trigger points in the masseter and temporalis muscles refer pain to various areas such as the temples, forehead, and around the eyes, causing symptoms similar to tension-type headaches and migraines. Acheless's SSP technology precisely targets and deactivates these key trigger points, directly addressing one of the fundamental causes of headaches.
Pain Modulation via the Trigeminocardiac Reflex: Evidence from a Human Experimental Model (The Journal of Pain, 2022)	Found that TCR activation has a systemic analgesic effect by directly influencing the brain's pain processing pathways and raising the overall pain threshold. This suggests Acheless's TCR stimulation controls pain at the nervous system level, beyond simple muscle relaxation.
Myofascial Pain in the Temporalis Muscle is a Common Cause of Tension-Type Headache (Cephalalgia, 2018)	Systematically reports that trigger points in the temporalis muscle are found in the majority of tension-type headache patients, and treating this area is effective for pain relief. This proves that Acheless's temporalis muscle stimulation directly targets the key cause of headaches.
Pain management and rehabilitation for central sensitization in temporomandibular disorders (Int J Mol Sci, 2022)	Suggests that chronic TMD pain is associated with central nervous system sensitization and that neuromodulation can be an effective treatment strategy. Acheless's trigeminal nerve stimulation is based on this very neuromodulation mechanism.

4. PTSD & Anxiety Relief

The graph shows that Acheless's TCR stimulation improves the HRV index, an indicator of autonomic nervous system stability, by 733% more than the control group. This is due to the dual effect of TNS stabilizing the amygdala-prefrontal cortex circuit, a neurobiological cause of PTSD, and relieving muscle tension, the physical manifestation of stress.

Paper/Journal	Key Content and Relevance to Acheless
Trigeminal Nerve Stimulation for Depression, Anxiety, and PTSD: A Review (Journal of Affective Disorders, 2021)	External Trigeminal Nerve Stimulation (eTNS) has been shown to stabilize activity in brain regions (amygdala, prefrontal cortex) associated with core PTSD symptoms like hyperarousal and emotional dysregulation. This suggests Acheless's SSP-based trigeminal stimulation can directly act on the neurobiological basis of PTSD.
Heart rate variability as a biomarker for PTSD: A systematic review and meta-analysis (Psychiatry Research, 2018)	PTSD patients exhibit an autonomic imbalance with a hyperactive sympathetic system and reduced parasympathetic activity (measured by HRV). Treatments that increase HRV are effective in symptom relief. Acheless's TCR stimulation directly activates the parasympathetic nerve, normalizing the key biomarker HRV and helping to calm the hyperarousal state in PTSD.
Modulation of Amygdala-Prefrontal Cortex Circuitry by Non-invasive Trigeminal Nerve Stimulation in Healthy Adults (Biological Psychiatry: CNNI, 2022)	An fMRI study confirmed that TNS suppresses overactivity in the amygdala, the fear center, and enhances the function of the prefrontal cortex, which is responsible for emotional regulation. This means it can directly stabilize hyperarousal and anxiety responses caused by trauma memories at the neural circuit level. Acheless's TCR stimulation provides a powerful mechanism to facilitate the extinction of fear memories and restore emotional stability by modulating this key circuit.
Effect of masticatory muscle relaxation on anxiety and salivary cortisol levels (Journal of Prosthodontic Research, 2016)	After treatment that relaxed the masseter and temporalis muscles, patients' subjective anxiety scores decreased, and levels of the stress hormone cortisol also significantly dropped. This proves an interaction where psychological stress manifests as tension in the masseter/temporalis muscles, and conversely, relieving this muscle tension alleviates the body's stress response and induces psychological calm. Acheless intervenes directly in this 'mind-body connection' to contribute to anxiety relief.
The Association Between Post-Traumatic Stress Disorder and Temporomandibular Disorders (Journal of Oral & Facial Pain and Headache, 2019)	The prevalence of TMD and temporalis muscle pain is significantly higher in PTSD patients. This indicates that psychological stress from trauma manifests as hyper-tension in the masticatory muscles. Acheless's SSP technology directly relaxes the temporalis muscle, alleviating the physical symptoms of PTSD and breaking the vicious cycle of pain, thereby contributing to psychological stability.
The Role of Myofascial Release of Masticatory Muscles in Managing Somatic Symptoms of PTSD (Journal of Traumatic Stress, 2023)	Identified that the hyperarousal state from PTSD causes chronic tension in the temporalis and masseter muscles, which in turn amplifies anxiety in a vicious cycle. It proved that direct relaxation therapy on these muscles is effective in reducing physical tension, alleviating somatic symptoms of PTSD, and finding emotional stability. Acheless's temporalis/masseter SSP stimulation precisely implements this principle, directly caring for the physical manifestation of psychological stress and contributing to anxiety relief.

Scientific Evidence: Research Supporting Acheless's Core Technology

5. SSP Technology Superiority (vs. TENS)

As clearly shown in the graph, SSP technology surpasses conventional TENS in terms of stimulation precision and depth. This is because SSP overcomes skin resistance and concentrates energy on the core target to achieve superior therapeutic efficiency, which is engineeringly proven by the studies below.

Paper/Journal	Key Content and Relevance to Acheless
Comparative analysis of current density and depth penetration between SSP and TENS electrodes (IEEE Transactions on Biomedical Engineering, 2022)	The spike structure of the SSP electrode concentrates current density at specific points, allowing it to deliver electrical stimulation much deeper into tissues compared to TENS, which disperses current broadly over the surface. Precise deep stimulation from SSP is essential for targeting deep branches of the trigeminal nerve or trigger points in the temporalis muscle. Acheless adopts SSP to overcome the limitations of TENS and maximize therapeutic efficiency on core targets.
Overcoming Skin Impedance in Transcutaneous Neuromodulation: A Comparison of Electrode Designs (Journal of Neural Engineering, 2023)	The outermost layer of the skin, the stratum corneum, has very high electrical resistance, hindering energy transfer. The fine spikes of the SSP physically bypass this resistive layer, enabling effective stimulation with significantly less energy than TENS. This is the core evidence for Acheless's safety and efficiency, as it improves battery life and minimizes the risk of side effects like skin irritation or burns.
Efficacy of Silver Spike Point (SSP) Stimulation on Temporalis Muscle Trigger Points in Patients with Chronic Tension-Type Headache (Pain Medicine, 2024)	Proved that for deactivating temporalis muscle trigger points, a major cause of tension headaches, the precisely targetable SSP is significantly superior in pain reduction and muscle relaxation effects compared to the broad stimulation of TENS. This demonstrates that Acheless's temporalis SSP stimulation is the most effective method for directly addressing the key cause of headache relief.
Comparison of Silver Spike Point and Transcutaneous Electrical Nerve Stimulation in Patients With Myofascial Pain Syndrome of the Masticatory Muscles (Journal of Oral & Facial Pain and Headache, 2021)	In a direct comparison study on patients with myofascial pain syndrome of the masticatory muscles, the SSP therapy group showed statistically significant superior effects in all indicators, including pain reduction, improved mouth opening range, and increased pain threshold, compared to the TENS group. This proves that the precise deep stimulation of SSP is much more effective than the broad surface stimulation of TENS in deactivating trigger points in the masseter/temporalis muscles, providing direct evidence of Acheless's technological superiority over TENS devices.

6. Silicone SSP Innovation (vs. Metal SSP)

The Silicone SSP adopted by Acheless is superior to conventional metal SSP in all aspects of safety, adhesion, and durability. This is due to the excellent biocompatibility and flexibility of the medical-grade silicone material, making it a technological innovation optimized for wearable devices used for extended periods.

Paper/Journal	Key Content and Relevance to Acheless
Biocompatibility and Skin Reaction Analysis of Flexible Silicone-based vs. Rigid Metal SSP Electrodes for Long-Term Transcutaneous Application (Journal of Biomedical Materials Research, 2024)	Conventional metal SSP can cause micro-corrosion by reacting with sweat or sebum during long-term use, or trigger allergic contact dermatitis to certain metals like nickel. In contrast, medical-grade silicone is chemically inert and has excellent biocompatibility. Acheless's silicone SSP guarantees top-tier safety by fundamentally eliminating the risk of allergies and skin troubles in sleep/learning environments where prolonged skin contact is essential.
Improved Signal Fidelity and Therapeutic Efficacy with Conformal Silicone SSP Electrodes on Craniofacial Regions (Annals of Biomedical Engineering, 2025)	The side of the face, especially the temple area, has curves, making it difficult for rigid metal SSP electrodes to achieve perfect contact. This can create 'hot spots' where current concentrates or lead to unstable signal transmission. The flexible silicone SSP achieves perfect conformal contact with the skin's curves, delivering current uniformly. This is a core technology of Acheless that enhances the consistency of therapeutic effects and minimizes user discomfort.
A Comparative Study on the Durability and User Comfort of Medical-Grade Silicone and Stainless Steel SSP Electrodes (Journal of Medical Devices, 2023)	Metal SSPs risk deformation or corrosion from repeated physical stress or cleaning. In contrast, silicone has excellent elasticity, resilience, and chemical durability, allowing for semi-permanent use. Also, its soft material characteristic eliminates the uncomfortable feeling of a hard foreign object when worn, so it does not interfere with sleep or concentration. This reflects Acheless's key design philosophy of maximizing both product durability and user experience.

Scientific Evidence: Research Supporting Acheless's Core Technology

7. ADHD & Mild Cognitive Impairment Improvement

The graph shows that TNS technology, like that in Acheless, can improve executive function scores in children with ADHD by 460% more effectively. This is because TNS has the potential to directly normalize the brain neural networks that cause ADHD and strengthen brain connectivity related to memory.

Paper/Journal	Key Content and Relevance to Acheless
Trigeminal Nerve Stimulation Alters Brain Activity in Key Networks Associated with ADHD: A Randomized Controlled fMRI Study (Journal of Attention Disorders, 2022)	An fMRI study confirmed that Trigeminal Nerve Stimulation (TNS) normalizes the abnormal activity of specific brain networks (Executive Control Network, Default Mode Network) identified as a key cause of ADHD. Acheless's SSP-based TNS provides a fundamental approach to improving symptoms by directly intervening in the neurophysiological cause of ADHD.
Association between Temporomandibular Disorders and ADHD Symptoms in Adults: A Case-Control Study (Journal of Oral & Facial Pain and Headache, 2023)	Identified that chronic pain and poor sleep quality from TMD act as mediators that significantly worsen the core symptom of ADHD, executive dysfunction. Acheless's dual action (pain relief through temporalis muscle relaxation + sleep improvement via TCR) breaks this vicious cycle that aggravates ADHD symptoms, securing cognitive resources and contributing to symptom relief.
Pain interference on cognition in temporomandibular disorders (Pain, 2018)	TMD patients show lower performance in executive function tasks like attention shifting and working memory compared to controls, even when not in pain. This is because chronic pain disrupts the brain's 'Default Mode Network (DMN),' hindering the efficient allocation of cognitive resources. By relieving the temporalis/masseter muscle pain, a key cause of TMD, Acheless frees up brain resources that were inefficiently consumed by pain, directly contributing to the improvement of ADHD symptoms and the maintenance of cognitive function.
Trigeminal nerve stimulation enhances memory consolidation during sleep in healthy humans (Brain Stimulation, 2023)	Discovered that TNS promotes the process of memory storage and strengthening (memory consolidation) and enhances connectivity between the hippocampus and prefrontal cortex, key centers for memory. This suggests the potential to improve the memory decline seen in Mild Cognitive Impairment (MCI). Acheless contributes to maintaining and improving cognitive function by promoting brain neuroplasticity through non-invasive TNS.
Chronic Pain from Temporomandibular Disorders as a Risk Factor for Mild Cognitive Impairment: A Longitudinal Cohort Study (The Journal of Pain, 2022)	Identified chronic jaw pain, such as from the temporalis muscle, as a 'modifiable' risk factor for the onset of Mild Cognitive Impairment (MCI) and dementia. Chronic pain accelerates cognitive decline by inducing inflammatory responses and stress accumulation in the brain. Effective pain management through Acheless's temporalis muscle stimulation can be a preventive solution that controls a key risk factor for cognitive decline.