

Normo-barik



Hiper-barik



Yara örtüsü



Topikal



O₂

Diyabetik Ayakta Temelli Tedaviler



• **Dr. Mesut MUTLUOĞLU**

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V. UDAIS 3-6 MAYIS 2018, Selçuk-İZMİR

Normo-barik



Hiper-barik



O₂

Yara örtüsü



Topikal

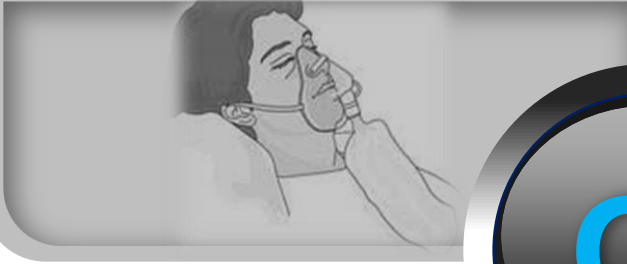


Sistemik  **tedavileri**



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Normo-barik



Hiper-barik



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Topikal

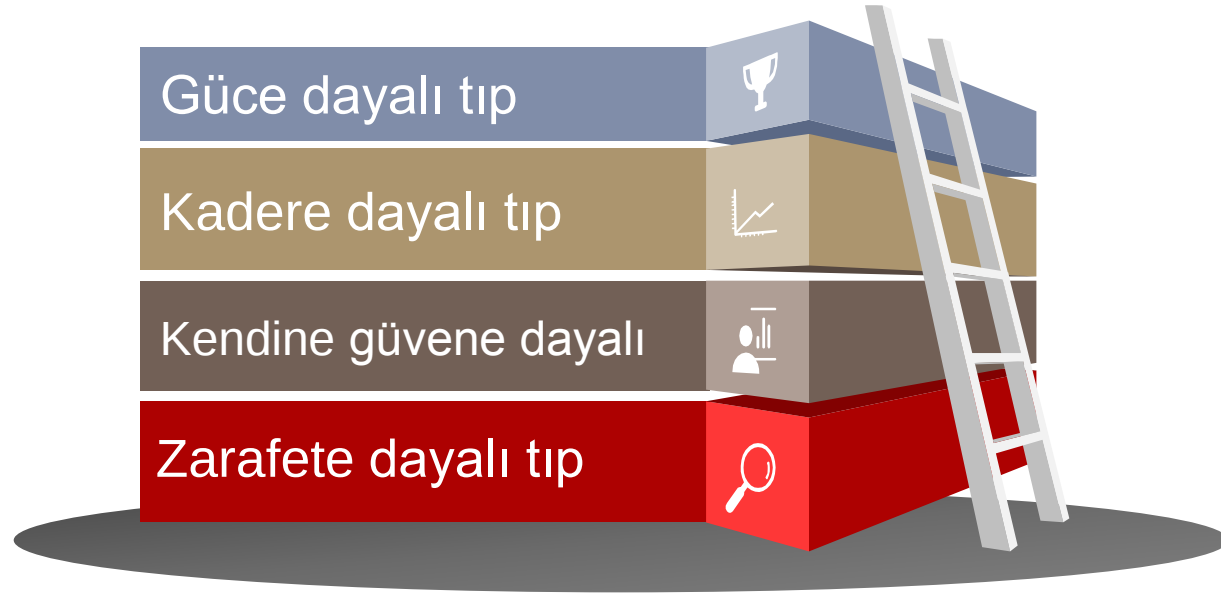
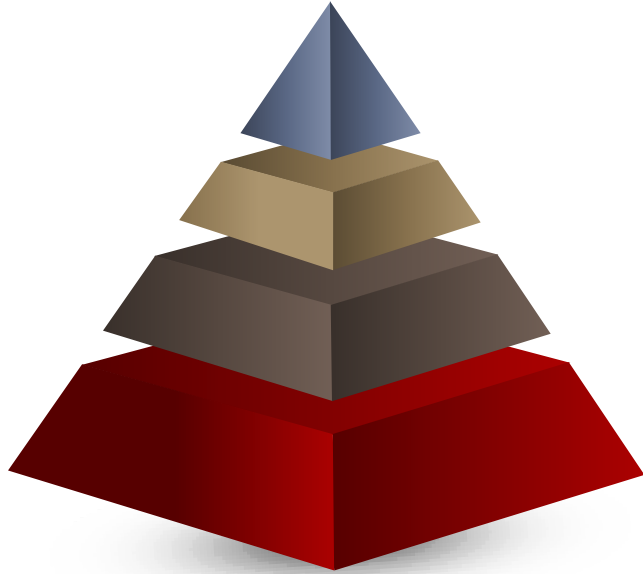


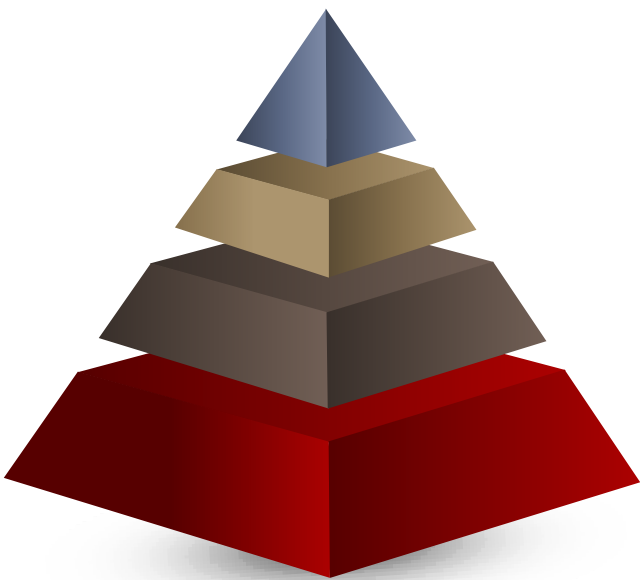
Lokal  **tedavileri**



V. UDAIS 3-6 MAYIS 2018, Selçuk-İZMİR

TOKLU Piramidi





Normo-barik



Hiper-barik



O₂

Yara örtüsü



Topikal



Sistemik  ***tedavileri***



V. UDAIS 3-6 MAYIS 2018, Selçuk-İZMİR

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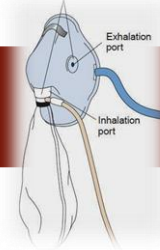
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Supplemental perioperative oxygen to reduce the incidence of surgical-wound infection.



Greif et al. 2000 NEJM



Çalışma Tasarımı

Randomize Kontrollü

Hasta sayısı

500

Hasta grupları

%80 O₂ vs. %30 O₂

Cerrahi süresince ve cerrahiden sonra 2 saat

Sonuçlar / n (%) SSI

28/250 (11.2) vs. 13/250 (5.2)

ARR % 6.0 (%95 CI, 1.2 -10.8)



Kısıtlar

10





Supplemental Postoperative Oxygen in the Prevention of Surgical Wound Infection after Lower Limb Vascular Surgery



Turtiainen et al. 2011 World J Surg



Çalışma Tasarımı

Randomize Kontrollü

Hasta sayısı

274

Hasta grupları

%30 O₂ vs. %20 O₂
Cerrahi sonrası 48 saat
(24 s Venturi mask – 24 s nazal kanül)

Sonuçlar / n (%) SSI

25/137 (18.2) vs. 38/137 (27.7)
[OR 0.56, 95% CI 0.30–1.04; P = 0.07].



Kısıtlar

Nazal kanül, %100 O₂ ???

11





High-concentration oxygen and surgical site infections in abdominal surgery: a meta-analysis



Patel et al. 2013 J Can Chir – Meta-Analysis

Çalışma Sayısı	6 RCT
Hasta sayısı	2585
Hasta grupları	% 80 O ₂ vs. %30-35 O ₂
Sonuçlar / SSI	[RR 0.77, 95% CI 0.50–1.19; P = 0.24].
Kısıtlar	



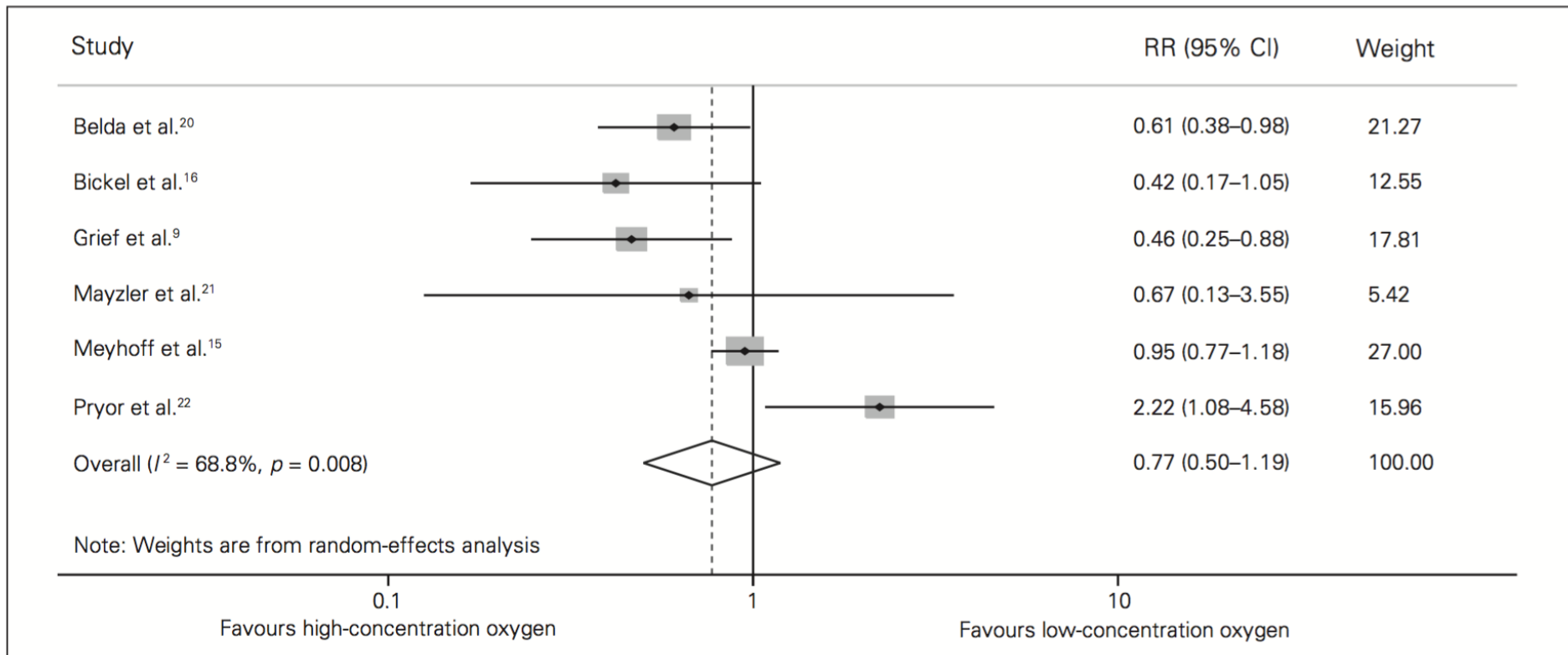
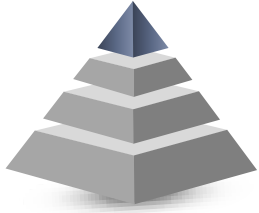


Fig. 2. Risk of surgical site infection in high-concentration and low-concentration oxygen groups (pooled risk ratio [RR] 0.77, 95% confidence interval [CI] 0.50–1.19, $p = 0.24$).



A meta-analysis of the effect of inspired oxygen concentration on the incidence of surgical site infection following cesarean section



Klingel & Patel 2013 Int J Ob Anes– Meta-Analysis

Çalışma Sayısı

5 RCT

Hasta sayısı

1966

Hasta grupları

>% 60 O₂ vs. <%40 O₂

Sonuçlar / SSI

[RR 1.12, 95% CI 0.86–1.46; P = 0.40].



Kısıtlar

14



Study.

%

ID.

RR (95% CI).

Weight

Williams 2012.

0.90 (0.41, 1.96).

12.36.

Scifres 2011.

1.39 (0.86, 2.25).

27.39.

Reyes 2012.

0.76 (0.33, 1.72).

13.30.

Gardella 2008.

1.82 (0.90, 3.70).

10.33.

Duggal 2011.

0.93 (0.59, 1.47).

36.63.

Overall (I-squared = 9.2%, $P = 0.354$).

1.12 (0.86, 1.46).

100.00.

.27.

1.

3.7.

Favours High Concentration Oxygen

Favours Low Concentration Oxygen

Normo-barik



Hiper-barik



O₂

Yara örtüsü



Topikal



Lokal  **tedavileri**



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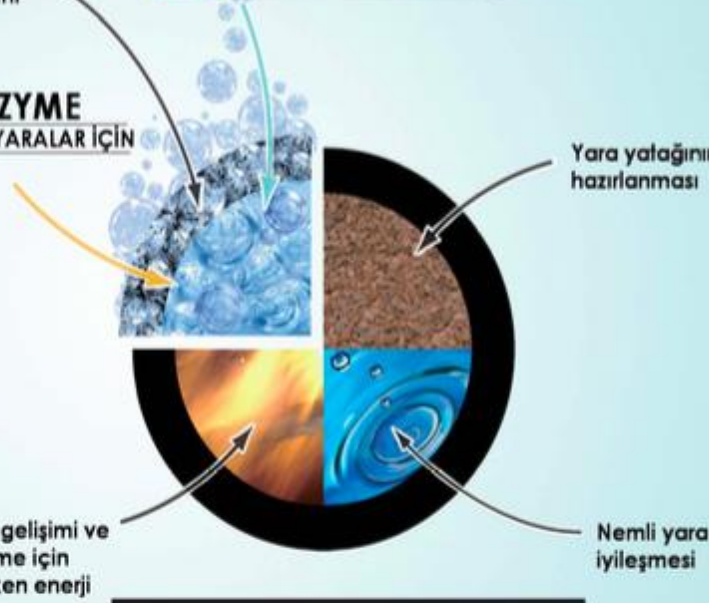
Oksijen Dengesi:
Yara bakımında
kayıp element



OXYZYME
ZOR İYİLEŞEN YARALAR İÇİN



IODOZYME
ENFEKTE YARALAR İÇİN



Yara yatağının
hazırlanması

Doku gelişimi ve
iyileşme için
gereken enerji

Nemli yara
iyileşmesi

**Yara bakımına yeni
bir bakış**

1 Jeller bir araya geldiklerinde glukoz enzim jelinin içerisine nüfuz eder ve glukoz oksidazı tetikler.

2 Havadaki oksijen ürünün içerisine nüfuz eder

Glukoz oksidaz içeren enzim hidrojel

Glukoz içeren yara temas hidrojel

3 Oksijen glukoz oksidaz'a bağlanır ve çözülebilir hidrojen peroksit'e dönüşür

Oksizyme ve Iodozyme, moleküler bir oksijen pompası gibi doğal bir enzim olan glukoz oksidaz'ı kullanarak çözülmüş oksijenin ürünün içerisinden geçerek yara yüzeyine yayılmasını sağlar.

Glukoz Oksidaz

Hidrojen Peroksit

Örtü tarafından üretilen oksijen ve iyodin miktarları yara ihtiyacına göre ayarlanmıştır.

Oksizyme çözülmüş oksijen ve az miktarda iyodin üretilir.

Iodozyme'de oksijen üretilir, ancak bu üründe iyodin miktar enfekte yaralarda kullanılmak üzere çok daha fazladır.

4 Peroksit ürünün içerisinden geçerek iyodid iyonları ile karşılaşır. Bu tepkime çözülmüş oksijen ve iyodin üretilmesini sağlar. Kalan hidrojen peroksit yara üzerinde anında oksijene dönüşür.

Hidrojen Peroksit

Iyodid

Iyodin

Oksijen

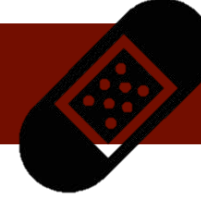




The Use of a Novel Oxygenating Hydrogel Dressing in the Treatment of Different Chronic Wounds (Oxyzyme)



Queen & Sibbald, 2007



Çalışma Tasarımı

Prospektif, Vaka Serisi

Hasta sayısı

4





The Use of a Novel Oxygenating Hydrogel Dressing in the Treatment of Different Chronic Wounds (Oxyzyme)

Figure 1.

CASE 1: WOUND ON ENTRY



Figure 2.

CASE 1: COMPLETE HEALING BY DAY 21



Figure 7.

CASE 4: WOUND ON ENTRY



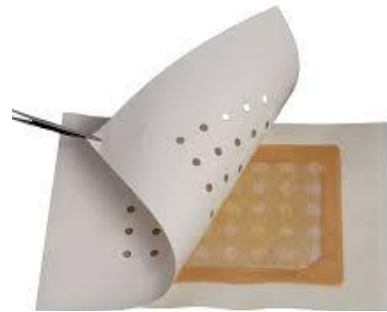
Figure 8.

CASE 4: COMPLETE HEALING BY DAY 14

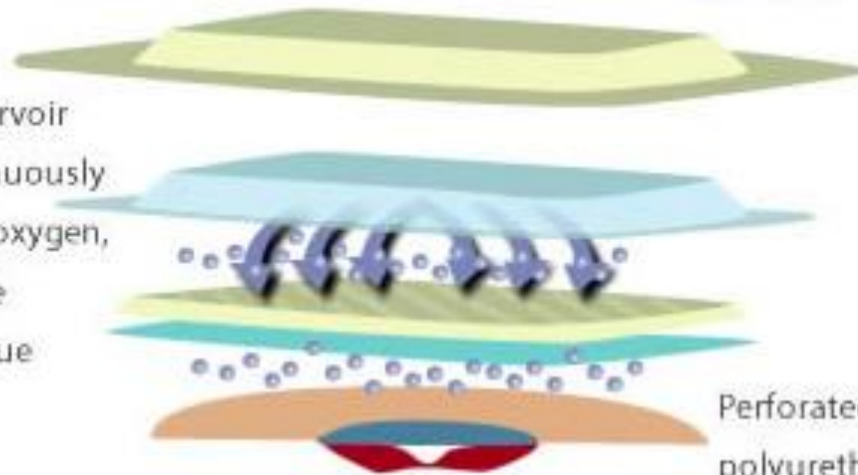


OxyBand™

TECHNOLOGIES



Patented reservoir system continuously diffuses pure oxygen, saturating the damaged tissue



Waterproof top layer provides a barrier to outside contaminants.

Perforated, hydrocolloid and polyurethane wound contact layer wicks exudates away from the wound into absorbent layer



Evaluation of an Oxygen-Diffusion Dressing for Accelerated Healing of Donor-Site Wounds (OxyBand)



lairet et al. & 2014 J Burn Care & Res.



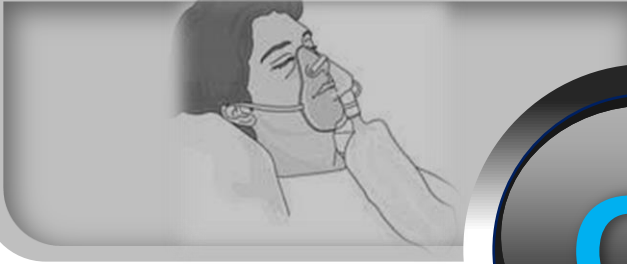
Çalışma Tasarımı	Randomize Kontrollü
Hasta sayısı	20
Kurgu	Donör saha iyileşmesi
Sonuçlar	Oxyband 9.4 ± 1.7 gün (6–12) vs. Xeroform 12.4 ± 2.7 gün (8–20) ($P < .01$).
Kısıtlar	Pansuman değ. postop. 4-8-10-12 ...
22	





Figure 1. Typical appearance of OxyBand dressing on a donor site.

Normo-barik



Hiper-barik



O₂

Yara örtüsü



Topikal



Lokal  **tedavileri**

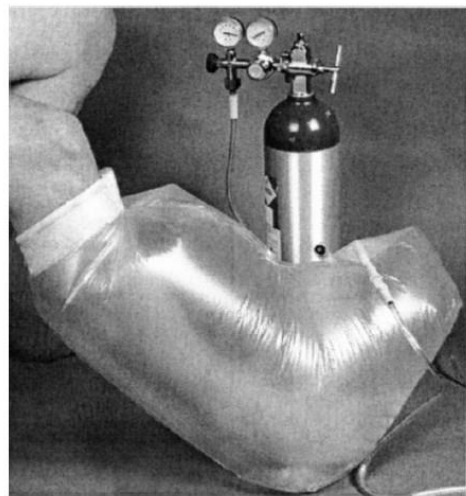


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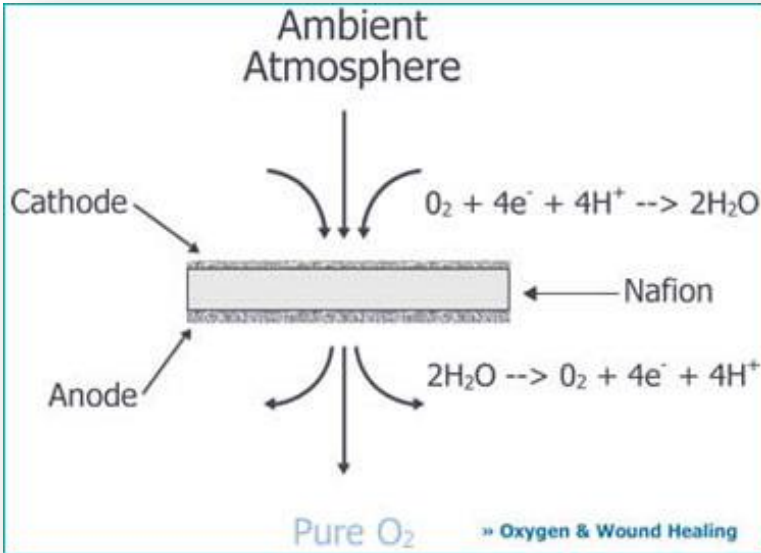
Introduction

THE beneficial effect of hyperbaric oxygen on some wounds and skin lesions ¹⁻⁴ suggested that similar effects might be expected if topical hyperbaric oxygen were used to treat skin ulcers and pressure sores.

Boguslav H. Fischer, 1969



TPOT
Topical Pressurized Oxygen Therapy



Ortalama tedavi Süresi **49 gün**, maliyet **\$47 / gün**, ya da **\$2450 / hasta**

Topical Oxygen for Chronic Wounds: A PRO/CON Debate



Mesut Mutluoglu, MD^{a,*}, Aslican Cakkalkurt, MD^b, Gunalp Uzun, MD^c,
Samil Aktas, MD^d



TOPICAL HYPERBARIC OXYGEN TREATMENT OF PRESSURE SORES AND SKIN ULCERS

BOGUSLAV H. FISCHER

Reprinted from THE LANCET, August 23, 1969, pp. 405-409

n=52

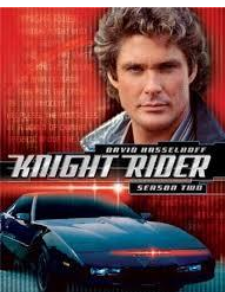


Reprinted from
The Journal of Dermatologic Surgery, Inc.
Vol. 1 No. 3 October 1975 Copyright © 1975

Treatment of Ulcers on the Legs With Hyperbaric Oxygen

BOGUSLAV H. FISCHER, M.D.

n=30



J Am Podiatry Assoc. 1982 Apr;72(4):180-5.

The effect of hyperbaric oxygen on lower extremity ulcerations.

Diamond E, Forst MB, Hyman SA, Rand SA.

n=?





HENG MEDICAL INC.

CAMARILLO, CALIFORNIA

HOME

PHYSICIANS

CONTACT

SOCIAL

"DEDICATED TO IMPROVING
WELLNESS FROM THE INSIDE OUT"



JAMA Dermatology

Article | May 1984

A Simplified Hyperbaric Oxygen Technique for Leg Ulcers

Madalene C. Y. Heng, MBBS, FRACP, FACD; Jennifer P. Pilgrim, MBBS; Francis W. J. Beck, MS

n=20

J Dermatol Surg Oncol. 1993 Aug;19(8):784-93.

Topical hyperbaric therapy for problem skin wounds.

Heng MC.

n=?

Ostomy Wound Manage. 2000 Sep;46(9):18-28, 30-2.

Angiogenesis in necrotic ulcers treated with hyperbaric oxygen.

Heng MC¹, Harker J, Csathy G, Marshall C, Brazier J, Sumampong S, Paterno Gomez E.

n=40

Ostomy Wound Manage. 2000 Mar;46(3):52-60, 62.

Enhanced healing and cost-effectiveness of low-pressure oxygen therapy in healing necrotic wounds: a feasibility study of technology transfer.

Heng MC¹, Harker J, Bardakjian VB, Avazian H.

n=15



Topical oxygen as an adjunct to wound healing: a clinical case series

Loree K. Kalliainen, Gayle M. Gordillo, Richard Schlanger, Chandan K. Sen*

Department of Surgery, 512 Davis Heart & Lung Research Institute, The Ohio State University Medical Center, 473 West 12th Avenue, Columbus, OH 43210, USA

Received 29 October 2002; accepted 4 November 2002

n=32

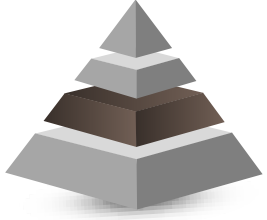
Clin Exp Pharmacol Physiol. 2008 August ; 35(8): 957–964. doi:10.1111/j.1440-1681.2008.04934.x.

Topical Oxygen Therapy Induces VEGF Expression and Improves Closure of Clinically Presented Chronic Wounds

Gayle M Gordillo^{1,2}, Sashwati Roy^{1,2}, Savita Khanna^{1,2}, Richard Schlanger^{1,2}, Sorabh Khandelwal^{1,3}, Gary Phillips⁴, and Chandan K. Sen^{1,2}

n=25





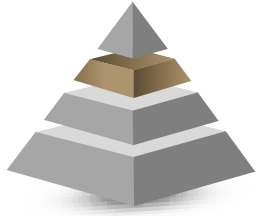
Topical wound oxygen therapy in the treatment of severe diabetic foot ulcers: a prospective controlled study.



Blackman et al. 2010 owm



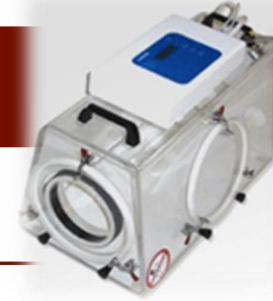
Çalışma Tasarımı	Vaka/kontrol	
Hasta sayısı	28	
Çalışma grupları	Çalışma grubu: Basınçlanmış TOT – 60dk/gün/60 seans – SF li gazlı bez Kontrol grubu: Gümüş emdirilmiş yara örtüsü, haftada 2 değişim.	
Sonuçlar / iyileşme	14/17 (%82.4) -56 gün 5/11 (%45.5) - 93 gün (P = 0.04)	
Kısıtlar	Plenty	
		32



Randomized controlled trial of topical hyperbaric oxygen for treatment of diabetic foot ulcers.

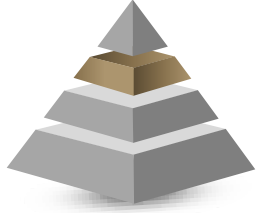


Leslie et al. 1988 D Care



Çalışma Tasarımı	RKÇ
Hasta sayısı	28
Çalışma grupları	Çalışma grubu (n:12): TOPOX 2* 90dk/gün/28 seans – ıslak-kuru pansuman Kontrol grubu (n:16): Islak-kuru pansuman
Sonuçlar / iyileşme	Ülser alanında değişim 45.6 ± 23.4% vs 35.6 ± 23% (p>0.05)
Kısıtlar	Hasta sayısı
33	





A prospective, randomized clinical study evaluating the effect of transdermal continuous oxygen therapy on biological processes and foot ulcer healing in persons with diabetes mellitus.



Drive et al. 2013 owm



Çalışma Tasarımı	RKÇ
Hasta sayısı	17
Çalışma grupları	Çalışma grubu (n :9) Kontrol grubu (n:8)
Sonuçlar / iyileşme	Yara çapında değişim %87 (%55.7-100) vs. %46 (%15-99); $p < 0.05$
Kısıtlar	Kısa süreli tedavi (4 hft) Hastalara iyileşene kadar takip edilmemiş
34	





Soru 7: Ozon Uygulamasının Diyabetik Ayak Yaralarının Tedavisindeki Yeri Nedir?



Ozon uygulamasının DA yaraları üzerine etkilerini ve bu hastalardaki etkinliğini ortaya koyacak yeterli kanıt bulunmamaktadır (143,144). **Günümüzde var olan kanıtlar ışığında DA yaralarında ozon tedavisi önerilmez.** Ozon uygulamasına bağlı ciddi **komplikasyonlar** gelişebileceği belirtilmiştir (145). Diyabeti olan hastalarda ozon uygulaması gibi alternatif tedavi yaklaşımlarının standard tedaviyi **geciktirebileceği** veya engelleyebileceği dikkate alınmalıdır (146).



Topical Ozone and Chronic Wounds: Improper Use of Therapeutic Tools May Delay Wound Healing

Dear Editor,

We present a patient with multiple non-healing lower extremity ulcers, and further discuss the inappropriate use of topical ozone therapy and the need for a comprehensive approach to wound management. A 40-year-old male patient, with diabetes mellitus and coronary artery disease of two years' duration, applied to our hyperbaric and wound care center for multiple non-healing necrotic ulcers over his legs [Figure 1]. Ulcers occurred around his ankles three months ago and spread proximally thereafter, despite topical antibiotic therapy and gauze dressings delivered at a local hospital. Sunk into despair, he was attracted from flyers advertising ozone therapy for chronic wounds. Thus, during the following four weeks, he received several topical ozone therapy sessions, which yielded no further significant signs of improvement. Eventually, he was suggested bilateral lower extremity amputation by a surgeon. On physical examination, he had multiple, necrotic, and infected deep ulcers in variable sizes reaching tendons in some areas [Figure 1]. The deep ulcers were managed with



Figure 1: He had multiple, necrotic, and infected deep ulcers on both legs



Figure 2: Almost all ulcers of both legs epithelized in 8 weeks

Bir diyabetik ayak olgusunda, 1mmHg' lik oksijen kısmi basıncı ile gelen iyileşme

- 86 Y ♂ / Tip 2 DM
- Diyabetik retinopati, nefropati, HT,
- 1 ay önce travma sonrası açılan yara
- Sağ ayak 5. MTB laterali
- Kemik temas testi (+)
- WBC: $8.1 \cdot 10^3/\text{mm}^3$
- ESR: 134 mm/h
- CRP: 201 mg/l
- Doku kültürü: *M.morganii*



- Ayak nabızları non-palpable
- Arteriyel doppler USG: **PTA** bifazik, **ATA** ve **ADP** filiform monofazik akım
- Transkütanöz oksimetri (TcPO²): **1mmHg** (yara çevresinde)



- Revaskülarizasyon sonucu sağ SFA'ya stent, diz altı arterleri rekanalize edilemedi
- Revaskülarizasyonun 10. gününde yara çevresinde **TcPO²: 33mmHg**
- 20. günde **TcPO²: 1mmHg**, normobarik %100 O² ile değişiklik yok.
- 20 seans HBO tedavisi ve antibiyoterapi (Piperasilin tazobaktam + linezolid)



- (E) 5. parmak amputasyonu ve debridman sonrası
- (F) NBYT ve intralezyoner EGF uygulamaları sonrası / TABURCU
- (G,H) Kollajen içelikli yara örtüleri ile ayaktan takip
- 150. günde **TcPO²: 30mmHg**

Hyperbaric, Transcutaneous Oximetry

Ercengiz A, Mutluoglu M.

Publication Details

Introduction

Transcutaneous oximetry (TcPO) is a non-invasive, simple and reliable diagnostic method used to assess peri-wound oxygenation and microcirculatory blood flow objectively. The term “peri-wound” should be emphasized because the measurement is taken at the edge of the wound and not at the center, where it would most likely be lower than the measured levels. Hypoxia is recognized as one of the most significant risk factors for non-healing wounds. It is, therefore, important to identify wound hypoxia early to provide an effective and accurate treatment plan.

Data indicate that hyperbaric oxygen therapy (HBOT) improves hypoxia and is frequently used in the management of non-healing wounds. TcPO measurement has helped our understanding of HBOT mechanisms in wound healing. One of the most significant observations related to HBOT was that, with TcPO use, although cutaneous blood flow decreased in the areas where oxygen pressure increased beyond normal levels, it did not decrease in areas where oxygen pressure remained subnormal. This evidence supported the view that unless oxygen pressure does not increase beyond normal values, the vasoconstrictive effect will not occur. Because HBOT is not readily available in all wound care centers and because it poses a significant burden to the healthcare system, the identification of patients most likely to benefit from HBOT is critical. TcPO, in this regard, is currently the most objective method for patient selection for HBOT.

The method relies on the placement of a Clark-type polarographic oxygen electrode on the skin where it heats up, usually to 43.5 C, causes vasodilatation in the underlying arterioles and capillaries, improves oxygen diffusion towards the electrode, and eventually provides the reading of the partial oxygen pressure at that specific site. An adhesive ring filled with a specific solution provides the attachment of the electrode to the skin. Following the attachment of the electrode, the application requires a strict calibration prior to the measurement. The system incorporates a thermistor which keeps the temperature between 42 C to 45 C and avoids thermal trauma.

Indications

TcPO was first used in neonatology, followed by pediatric intensive care units and then spread to other disciplines including plastic surgery, vascular surgery, anesthesiology, orthopedics and hyperbaric medicine.



Sabrınız için teşekkürler