

Telemedicine ve Diyabetik Ayak

Dr. L. Nilsun Altunal

Saęlık Bilimleri Üniversitesi Ümraniye Eğitim ve Araştırma Hastanesi
Enfeksiyon Hastalıkları ve Klinik Mikrobiyoloji

Telemedicine-Teletıp

- Birbirinden uzak mekanlar arasında, bilgi ve iletişim teknolojileri ile sağlık hizmeti sunumu
 - Kullanılan teknolojiler:
 - Sakla ve gönder
 - Gerçek zamanlı
 - Uzaktan kontrol
 - Veri alışverişi büyük ölçüde internet ile yapılmaktadır
- Kırsal alan sağlık kurumları
 - Açık deniz gemileri
 - Kutup istasyonları
 - Askeri birlikler
 - Uzay istasyonu
 - Ambulans-hastane
 - Ev-hastane-medikal izleme merkezi

Teletıp

- Kaliteli sađlık hizmeti uzak mesafelere ulařtırılır
- Doktor ve hastanın aynı yerde bulunma zorunluluđu ortadan kaldırılır
- Hastaların uzaktan takibi ile hastane masrafları azalır
- Tanı ve tedavi sürecinde bölgesel farklılıklar ortadan kaldırılır
- Zaman tasarrufu sađlanır
- Bilgiye zamanında ulařılabilir

Özellikle kronik hastalıklar:

- Diyabet
- Hipertansiyon ve kardiyolojik hastalıklar
- Psikiyatri
- Koruyucu sađlık hizmetleri
- Yara bakımı
- KOAH, Astım , Alerji
- Post-op, pre-op takip
- Riskli gebelikler

Teletıp

- 2000'lerin başından beri gündemde
- COVID-19 pandemisiyle hem bilimsel literatürde hem de pratikte popülerliği arttı
- İletişim altyapısı (Bağlantı teknolojilerine yönelik internet vb)
- Hedefe yönelik yazılım (Kullanılacak cihazların uyumu ve iletişimi)
- Eğitimli insan gücü

Ülkemizde Teletıp

10 Şubat 2022 PERŞEMBE

Resmî Gazete

Sayı : 31746

YÖNETMELİK

Sağlık Bakanlıđından:

UZAKTAN SAĞLIK HİZMETLERİNİN SUNUMU HAKKINDA YÖNETMELİK

Amaç

MADDE 1 – (1) Bu Yönetmeliđin amacı, sağlık hizmetinin mekândan ve coğrafyadan bağımsız olarak ve çağdaş tıbbi teknolojiye dayanılarak sunulmasına hizmet etmek üzere; uzaktan sağlık hizmetinin kapsamına, uzaktan sağlık hizmeti sunacak sağlık tesislerine izin verilmesine, uzaktan sağlık bilgi sisteminin geliştirilmesine, tescil edilmesine, sağlık tesislerinin bu kapsamda denetlenmesine ilişkin usul ve esasları düzenlemektir.

(26.03.2015 tarihli ve 38110390/010.04/644 sayılı Bakanlık Makam Onayı)

TELE SAĞLIK SERVİSİ UYGULAMA USUL VE ESASLARI HAKKINDA YÖNERGE

- İlk bağlantı 1997
- PACS uygulamaları 2000
- Özel sektör uygulamaları 2006
- Sağlık Bakanlığı Projesi 2008
- İstanbul Teleradyoloji Projesi 2009
- Askeri Teleradyoloji Projesi 2010



Teletıp-Dezavantajları

- Teknolojik aksaklıklar
- Teknik altyapı yetersizlikleri
- Sunucu ve alıcının teknolojiye erişim imkanları
- Mevzuat boşluğu (hukuki kaygılar)
- Tıbbi etik açısından kaygılar
- İlgili alan ve uygulama amacına ilişkin özgül kanıt eksikliği

Teletıp ve diyabetik ayak

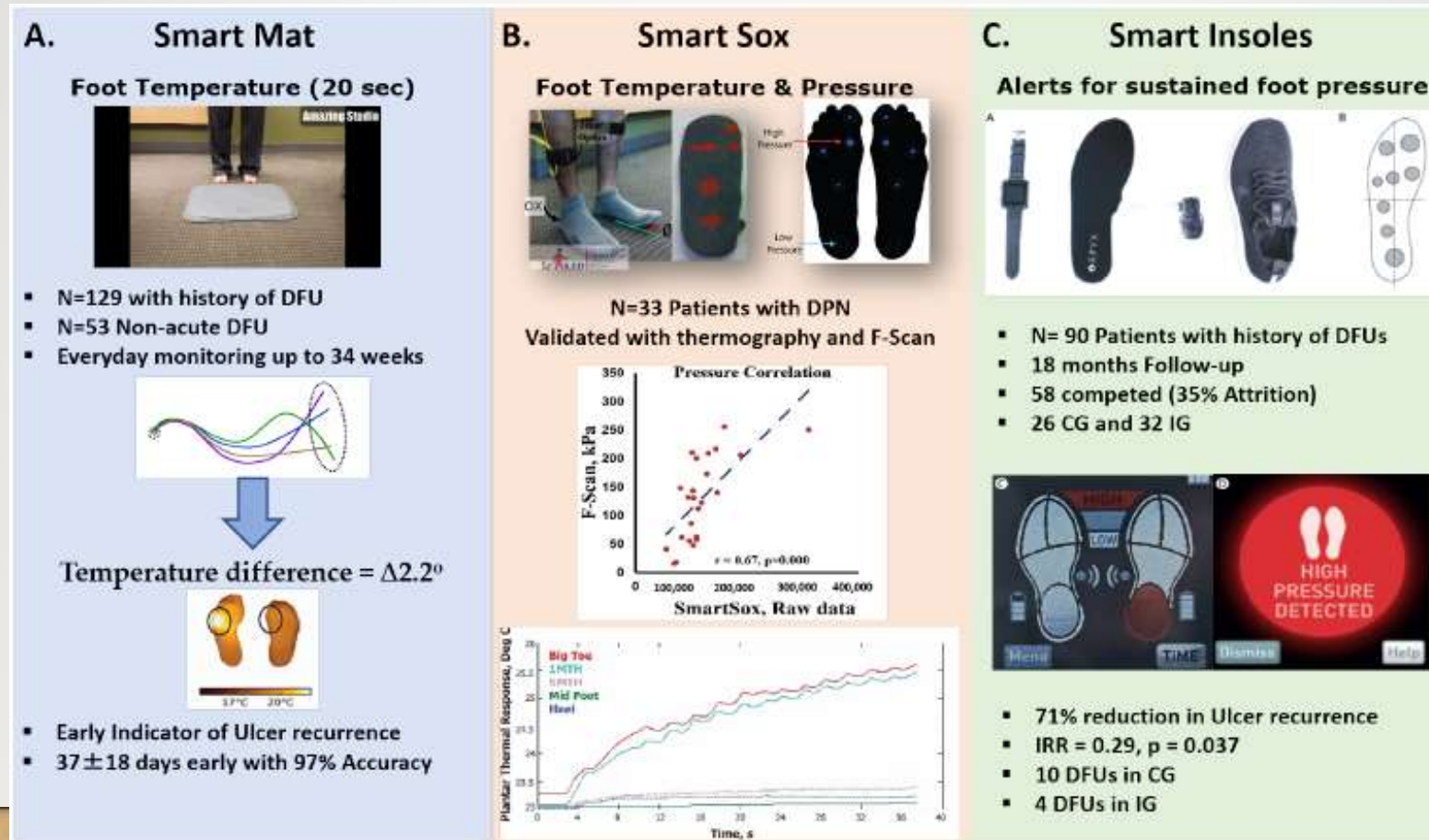
- Teletıp, diyabet tanılı hastaların yaşadıkları yerde
 - Ayak sağlığı durumlarının izlenmesine
 - Diyabetik ayak yarası için risk değerlendirmesi yapılmasına
 - Tanı, tedavi ve eğitim amacıyla verilen bakımın etkinliğinin belirlenmesine
 - Hastanın kendi kendine ayak bakımı yapmasına olanak sağlar



Teletıp ve teknolojik gelişmeler

- Diyabetik ayak ülseri riskinin değerlendirilmesinde kullanılan uzaktan izlenilebilen giyilebilir sağlık teknolojileri:
 - Ayak sıcaklığının izleyen sistemler
 - Plantar basıncı takip eden sistemler
- Ayak görüntüleme araçları
- Cep telefonu/video
- Çevrimiçi destek uygulamaları
- Glukozun sürekli izlenmesi için giyilebilir ya da implante edilebilen teknolojiler

Uzaktan izlenilebilen giyilebilir sağlık teknolojileri



Telemedical home-monitoring of diabetic foot disease using photographic foot imaging--a feasibility study

- Riskli hastalarda komplikasyonlar ile seyredebilecek diyabetik ayak yarasının erken tanısında önemli

Abstract

We assessed the feasibility of using a photographic foot imaging device (PFID) as a tele-monitoring tool in the home environment of patients with diabetes who were at high risk of ulceration. Images of the plantar foot were taken three times a week over a period of four months in the home of 22 high-risk patients. The images were remotely assessed by a diabetic foot specialist. At the end of the study, 12% of images were missing, mainly due to modem or server failures (66%), or non-adherence (11%). All three referrals for diagnosed ulcers and 31 of 32 referrals for abundant callus resulted in treatment. Health-related quality of life (EQ-5D visual analogue scale), increased from 7.5 at baseline to 7.9 at end of follow-up, but not significantly. Mean scores on a visual analogue scale for different usability domains



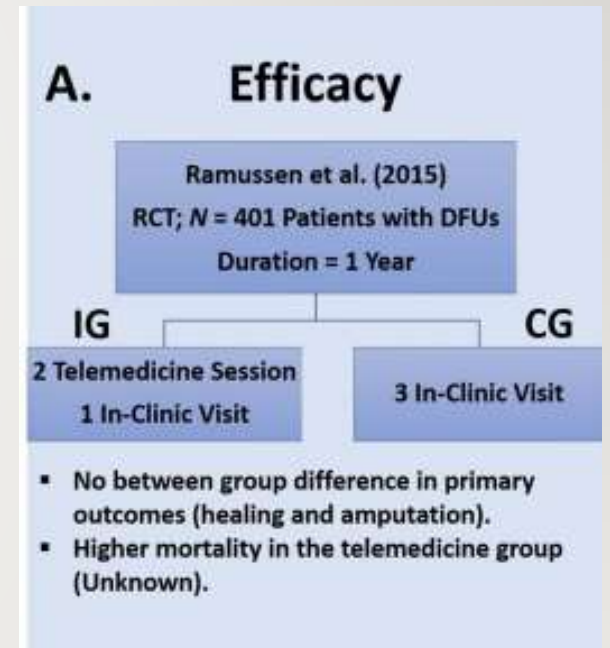
Figure 1 The photographic foot imaging device

Teletıp-Etkinlik

- Standart izlem ile teletıp karşılaştırıldığında
 - Amputasyon ve iyileşme açısından fark yok
 - Mortalite teletıp grubunda yüksek

Results: One hundred ninety-three individuals were randomized to telemedical monitoring and 181 to standard care. Demographics were similar in both groups. A cause-specific Cox proportional hazards model showed no difference in individuals monitored through telemedicine regarding wound healing (hazard ratio 1.11 [95% CI 0.87, 1.42], $P = 0.42$) or amputation (0.87 [0.54, 1.42], $P = 0.59$). We found a higher mortality incidence in the telemedical monitoring group compared with the standard outpatient monitoring group (8.68 [6.93, 10.88], $P = 0.0001$).

A Randomized Controlled Trial Comparing Telemedical and Standard Outpatient Monitoring of Diabetic Foot Ulcers



Teletıp-Etkinlik

The Effect of Telemedicine Follow-up Care on Diabetes-Related Foot Ulcers: A Cluster-Randomized Controlled Noninferiority Trial

- Diyabetik ayak ülseri takibinde teletıp ve standart bakım arasında iyileşme zamanı, mortalitede açısından anlamlı fark bulunmamış.

Results: Using mixed-effects regression analysis, we found that TM was noninferior to SOC regarding healing time (mean difference -0.43 months, 95% CI -1.50, 0.65). When competing risk from death and amputation were taken into account, there was no significant difference in healing time between the groups (subhazard ratio 1.16, 95% CI 0.85, 1.59). The TM group had a significantly lower proportion of amputations (mean difference -8.3%, 95% CI -16.3%, -0.5%), and there were no significant differences in the proportion of deaths, number of consultations, or patient satisfaction between groups, although the direction of the effect estimates for these clinical outcomes favored the TM group.

Conclusions: The results suggest that use of TM technology can be a relevant alternative and supplement to usual care, at least for patients with more superficial ulcers.

Efficacy of telemedicine applications in patients with diabetic foot ulcers: A focus on mortality and major amputation rates

Teletıp-Etkinlik

- Diyabeti ayak konseyinin COVID-19 pandemisi döneminde teletıp ile hasta değerlendirmesi amputasyon ve mortalite açısından fark yaratmamış

Abstract

Amputations related to diabetic foot ulcers (DFU) are associated with high morbidity and mortality rates. Glycaemic control and close follow-up protocols are essential to prevent such ulcers. Coronavirus disease (COVID) related restrictions and regulations might have a negative impact on patients who are with DFU or candidates for DFU. We retrospectively analysed 126 cases that had DFU underwent amputation surgery. Comparative analyses were done between cases that were admitted before COVID restrictions (Group A) and cases admitted after COVID restrictions (Group B). Two groups were homogenic demographically. There was no significant difference between groups in terms of mortality ($p = 0.239$) and amputation rates ($p = 0.461$). The number of emergent cases in the pandemic period doubled the number in pre-pandemic period even though this finding was not statistically significant ($p = 0.112$). Fastly adapted consulting practice and follow-up protocols to compensate for the problems created by COVID-related regulations seem to be effective in terms of mortality and amputation rates.

Teletıp-Etkinlik

- 10 çalışma, 1678 hasta
- Teletıp ile amputasyon ve maliyette anlamlı azalma
- Glukoz ve glukolize hemoglobin kontrolü daha iyi

The Effect of Telemedicine Interventions on Patients with Diabetic Foot Ulcers: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Abstract

Objective: The meta-analysis was performed to evaluate the effectiveness of telemedicine interventions on patients with diabetic foot ulcers (DFU). **Approach:** The authors conducted a comprehensive search across eight databases. The aim was to identify randomized controlled trials examining the effectiveness of telemedicine for patients with DFU. Methodological qualities of included studies were assessed using *Cochrane Handbook for Systematic Reviews of Intervention*. Subsequently, a meta-analysis was conducted using RevMan 5.3 to synthesize the findings. **Results:** Ten studies involving 1,678 patients with DFU were included in the meta-analysis. In comparison to the face-to-face intervention group, telemedicine interventions significantly reduced the amputation rate (risk ratio = 0.64, 95% confidence interval [CI] = 0.44-0.92, $p = 0.02$), decreased costs (mean difference [MD] = -4158.51, 95% CI = -7304.69 to -1012.34, $p = 0.01$), better controlled fasting blood glucose (MD = -0.89, 95% CI = -1.43 to -0.36, $p = 0.001$), and achieved superior glycated hemoglobin control (MD = -0.71, 95% CI = -1.01 to -0.41, $p < 0.00001$). No significant differences were observed between the telemedicine group and the face-to-face group in terms of healing rate, mortality, and healing time. **Innovations:** Our study suggests that telemedicine is a viable strategy for managing

İyileşme oranı, mortalite ve iyileşme zamanı açısından anlamlı farklılık yok

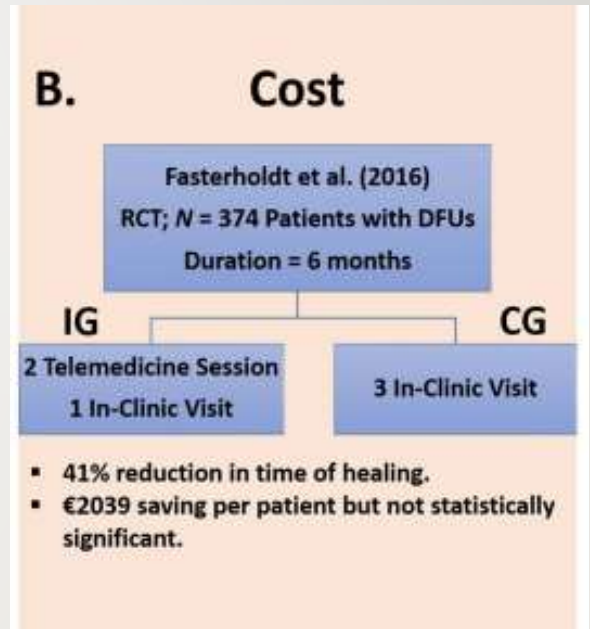
Teletıp-Maliyet

Cost-effectiveness of telemonitoring of diabetic foot ulcer patients

- Standart izlem ile teletıp karşılaştırıldığında
 - Teletıp ile iyileşme zamanı %41 azalmakta
 - 2029 € tasarruf (İstatistiksel olarak anlamlı bulunmamış)

Abstract

This study compared the cost-effectiveness of telemonitoring with standard monitoring for patients with diabetic foot ulcers. The economic evaluation was nested within a pragmatic randomised controlled trial. A total of 374 patients were randomised to either telemonitoring or standard monitoring. Telemonitoring consisted of two tele-consultations in the patient's own home and one consultation at the outpatient clinic; standard monitoring consisted of three outpatient clinic consultations. Total healthcare costs were estimated over a 6-month period at individual patient level, from a healthcare sector perspective. The bootstrap method was used to calculate the incremental cost-effectiveness ratio, and one-way sensitivity analyses were performed. **Telemonitoring costs were found to be €2039 less per patient compared to standard monitoring; however, this difference was not statistically significant. Amputation rate was similar in the two groups.** In conclusion, a telemonitoring service in this form had similar costs and effects as standard monitoring.



Teletıp-Maliyet

Hospital stays and costs of telemedical monitoring versus standard follow-up for diabetic foot ulcer: an open-label randomised controlled study

	Control group ^a (n = 90)	Intervention group ^a (n = 90)	Adjusted mean difference ^a	Statistical significance
Primary outcome				
Days spent in hospital (cumulated over 1 year)	13.4 (9.0-17.8)	7.1 (2.8-11.5)	6.3 (0.1-12.4)	p = 0.0458 ^b
Secondary outcomes (main)				
Direct costs (€, cumulated over 1 year)	7185 (5144-9226)	3471 (1430-5512)	3714 (827-6600)	p = 0.0120 ^b
Healing rate (%)	52.4 (41.3-61.7)	62.1 (53.2-71.0)	-9.7 (-21.1 to 2.7)	p = 0.1246 ^c {p = 0.0025} ^d
Amputation rate (%)	15.6 (8.1-23.1)	12.4 (5.2-19.5)	3.2 (-7.0 to 13.4)	p = 0.5356 ^e {p = 0.8637} ^d
Secondary outcomes (others)				
Mean duration of hospitalization (days)	4.1 (0.8) 2.5-5.8	3.3 (0.8) 1.7-5.0	0.8 -1.5 to 3.2	p = 0.4947 ^e {p = 0.3448} ^d
Number of DFU per patients	2.6 (0.3) 2.0-3.2	2.0 (0.3) 1.4-2.5	0.58 -0.2 to 1.4	p = 0.1543 ^b {p = 0.2344} ^d
Delay to first improvement (days)	77 58-98	21 15-37	n.a.	p = 0.0002 ^f n.a.
Delay to first aggravation (days)	213 126-319	>365 196-(n.a.)	n.a.	p = 0.0362 ^f n.a.
Delay to healing (days)	98 70-149	85 49-113	n.a.	p = 0.1031 ^f n.a.
Number of DFU follow-up visits ^g	4.2 (0.4) [2.0; 6.0]	6.7 (0.5) [3.0; 10.0]	n.a.	p < 0.001 ^h -
Number of visits from expert nurse ^d	n.a.	10.0 (0.6) [6.0; 14.0]	n.a.	n.a.

^aData given as mean (SE, upper line) and 95% CI (lower line; except for IQR, see^g). ^bANCOVA model (results confirmed with a GEE model, see text). ^cGEE model. ^dStatistical significance of the covariate (ABI). ^eANCOVA. ^fKaplan-Meier survival time analysis (0.75 survival probability; see text). ^gIQR, between square brackets. ^hStatistical significance evaluated with a Wilcoxon test.

Table 3: Trial outcomes for the ITT population.

Teletıp- Güvenilirlik

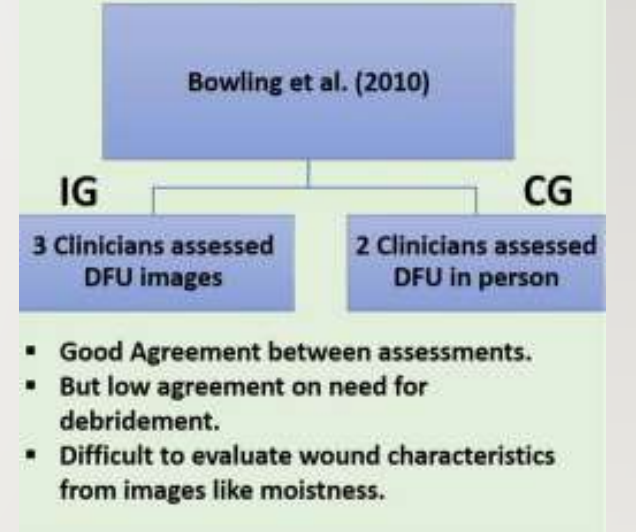
Remote assessment of diabetic foot ulcers using a novel wound imaging system

- Standart izlem ile teletıp karşılaştırıldığında
 - Teletıp ile iyi değerlendirme yapılabilmekte
 - Yaranın karakteristik özellikleri ve debridman ihtiyacı açısından değerlendirme zorlukları mevcut

Abstract

Telemedicine allows experts to assess patients in remote locations, enabling quality convenient, cost-effective care. To help assess foot wounds remotely, we investigated the reliability of a novel optical imaging system employing a three-dimensional camera and disposable optical marker. We first examined inter- and intraoperator measurement variability (correlation coefficient) of five clinicians examining three different wounds. Then, to assess of the system's ability to identify key clinically relevant features, we had two clinicians evaluate 20 different wounds at two centers, recording observations on a standardized form. Three other clinicians recorded their observations using only the corresponding three-dimensional images. Using the in-person assessment as the criterion standard, we assessed concordance of the remote with in-person assessments. Measurement variation of area was 3.3% for intraoperator and 11.9% for interoperator; difference in clinician opinion about wound boundary location was significant. Overall agreement for remote vs. in-person assessments was good, but was lowest on the subjective clinical assessments, e.g., value of debridement to improve healing. Limitations of imaging included inability to show certain characteristics, e.g., moistness or exudation. Clinicians gave positive feedback on visual fidelity. This pilot study showed that a clinician viewing only the three-dimensional images could accurately measure and assess a diabetic foot wound remotely.

C. Reliability



Wound Repair Regen. 2011 Jan-Feb;19(1):25-30.

Teletıp- Güvenilirlik

Telemedicine and diabetic foot ulcer outcomes. A meta-analysis of controlled trials

- Teletıp, standart bakım kadar etkili olabilir
- Daha fazla hastanın dahil edildiği randomize kontrollü çalışmalara ihtiyaç var

Abstract

Telemedicine (TM) has been advanced as an effective approach to wound care management. In this era of COVID-19 pandemic, it is paramount to assess the evidence behind the use of TM in treating diabetic foot ulcers (DFU). This meta-analysis aims at evaluating the efficacy of TM versus face-to-face attendance in managing DFU. In total, four controlled studies were included in the meta-analysis comprising 3 randomized trials. The total pooled sample comprised 816 patients (816 ulcers): 337 in TM group and 479 in the control group. The results were as follows: (a) healing rate OR was 1.35, in favor of TM ($p = 0.4$), (b) time to heal with means of 73 ± 24.1 days and 83.5 ± 28.4 days, for the TM and control group, respectively ($p = 0.35$), (c) the amputation rate OR was 0.48 ($p = 0.007$) in favor of the TM group, (d) the mortality rate OR was 1.66 ($p = 0.2$), and (e) a trend for lesser cost than face-to-face group ($p = 0.4$). While future research using large-sampled controlled studies is warranted, the present meta-analysis demonstrated that treating DFU via TM could be at least as effective as to face-to-face attendance. In times where clinic visits are reduced or not possible such as during this COVID-19 pandemic and the likely-to-happen future outbreaks, TM could be a valuable alternative.

Foot (Edinb). 2022 Mar;50:101872.

Sonuç

- Teletıp, teknolojideki gelişmelerin sayesinde diyabetik ayak ülserlerinin takibinde iyi bir alternatif
- Özellikle pandemi döneminde, sağlık kuruluşuna ulaşım zorluğu gibi durumlarda oldukça yardımcı
- Uzaktan izlenilebilen giyilebilir sağlık teknolojileriyle ülserin diğer özelliklerinin de değerlendirilmesi daha yol gösterici
- İnternet erişimi, bilgisayar gibi teknik alt yapılar gereksinimleri mevcut



Teşekkürler