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THE ROLE OF HBO-THERAPY IN THE TREATMENT OF OSTEO-MYELITIS OF THE JAW. A RETROSPECTIVE ANALYSIS OF PATIENTS TREATED AT THE DEPARTMENT OF CRANIO-MAXILLOFACIAL SURGERY IN ZÜRICH (1988-2000)

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Introduction

Hyperbaric oxygen therapy (HBO) plays a well accepted role in the therapeutic armamentarium used in maxillofacial surgery for various indications (Table 1). While the use of HBO is well established for treatment of osteoradionecrosis and irradiated tissue with proven benefits in retrospective and prospective **randomized** trials¹⁷, its **role in Osteomyelitis therapy however** is to date still insufficiently documented and therefore somewhat controversial. The medical and dental literature to date consists merely of retrospective analysis on small and inhomogeneous patient groups or case reports, lacking clear conclusions^{8,12}. The purpose of this study is to evaluate the role of HBO-therapy in our patient data with mandibular **Osteomyelitis** that were treated in the past 12 years in our department.

Table 1 (modified after Haers PE, Grätz KW, Schenk B, Sailer HF')

Indications of HBO in Oral- and Maxillofacial Surgery

Wound healing problems Critical grafts Osteoradionecrosis

Irradiated tissue Osteomyelitis

primary chronic Osteomyelitis (refractory) secondary chronic

Osteomyelitis Cervicofacial Actinomycosis

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Materials and Methods

Records from patients with Osteomyelitis treated with adjunctive HBO-therapy were reviewed from 1988- 2000. Less than 20 HBO sessions were not considered of therapeutic value, hence these patients were excluded from the study. Further only patients with acute Osteomyelitis (AO) and secondary chronic Osteomyelitis (SCO) were included. Due to the very controversial results of HBO and other therapeutic modalities in primary chronic Osteomyelitis (PCO), these patients were excluded from the study. 43 patients met these criteria and showed sufficient documentation. A control group with an equal number of patients (43) with AO and SCO, treated in the same time period without adjunctive HBO-therapy, was randomly picked. The 86 cases consisted of 60 male and 26 female patients with a mean age of 45.6 years (range 6-89 years), the mean follow up time was 1.62 years (range 0.25 - 9 years). Both groups demonstrated homogenous demographic features with exception of their medical history. In the group with HBO-therapy there were significantly more patients with a history of alcoholism and cigarette-smoking (18 respectively 25 patients) compared to the group without HBO-therapy (12 respectively 18 patients). Treatment modalities were reviewed regarding surgery and HBO-therapy. Surgical procedures were divided into two groups, procedures involving major bone debridement (e.g. decortication, resection or extensive local revision) and minor procedures (incision and drainage and removal of the dental focus). HBO₂ was applied daily (5 days a week) in a multiplace Chamber at a pressure of 2 ATA. Oxygen was applied via head tent for 90 minutes with an air break of 5 minutes in the middle of the session. The partial pressure of oxygen in the head tent was measured 10 minutes after the beginning of oxygen inhalation and 10 minutes after the air brake. FiO₂ ranged from 91 to 98% with an average of 95%.

The outcome of therapy was evaluated regarding the symptoms at the end of the follow-up period. Patients with hypoesthesia were considered as free of symptoms if they underwent a major surgical procedure causing possible nerve damage. Outcome with preoperative, postoperative and combined (at least 10 sessions HBO pre- and postoperative) HBO-Therapy was analyzed. Medium-term antibiotic treatment (usually Clindamycin 3x300mg/d p.o. or cefuroxim 2x500mg/d p.o. at least 4 days) was administered in all 86 cases and therefore considered a relatively constant parameter.

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Results

43 patients received 25.4 HBO sessions in average (range 20-52). 7 patients received preoperative, 28 postoperative and 8 pre- and postoperative HBO-therapy. Of the patients treated without adjuvant HBO-therapy 36 (84%) underwent surgical procedures involving gross bone debridement, while only 28 patients receiving HBO-therapy (65%) needed such surgery, whereas in the HBO group 12 patients (28%) received minor surgical procedures compared with 5 (14%) in the group without HBO-therapy. The mean number of major surgical procedures in the HBO group was 1.36 (range 1-4) compared to 1.17 (range 1-3) in the group without HBO-therapy (Figure 1).

28 patients (65%) with HBO-therapy and 31 (72%) without HBO were completely free of symptoms at the end of the follow up period. 10 patients (23%) with, and 8 patients (19%) without HBO therapy had minor residual symptoms, only in 5 (12%), respectively 4 patients (9%) the symptoms remained unchanged. None of the patients experienced a worsening of symptoms.

4 patients (57%) with preoperative HBO (mean 28.3 sessions; range 20-39), 19 patients (68%) with postoperative (mean 25.1 sessions, range 19-52) and 5 patients (62.5%) with combined HBO therapy (mean 11 sessions preoperative, range 11-15; mean 14.8 sessions postoperative, range 10-30) were considered free of symptoms at the end of the follow-up period. In 3 patients (43%) with preoperative HBO, 4 patients (14%) with postoperative HBO and 3 patients (37.5%) with combined HBO treatment a significant reduction of symptoms was observed. In 5 patients (18%) with postoperative HBO no change of symptoms was observed.

Surgical Procedures

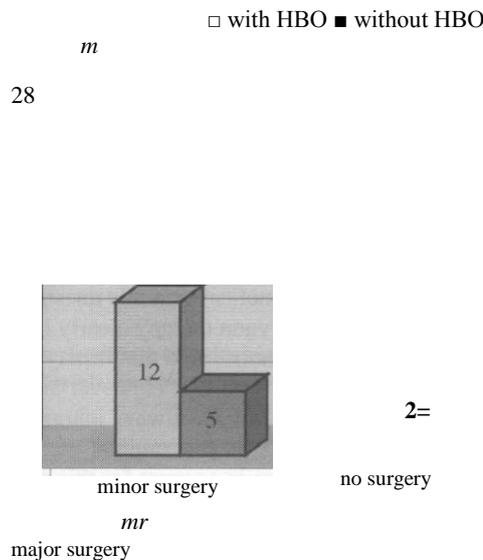
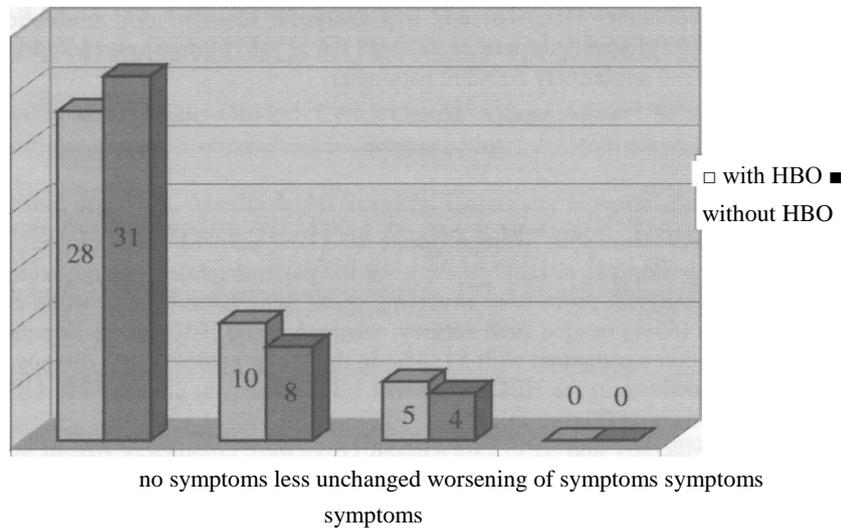


Figure 1

major surgery: decortication, (partial) resection, extensive local debridement minor surgery: local incision and drainage, removal of dental focus

Clinical symptoms at End of Follow-up Period



Discussion

The outcome of patients treated with adjunctive HBO-therapy aside from antibiotics and surgery was slightly worse than in patients without HBO-therapy. This may be explained by the fact that patients who were surgery and antibiotics have not resulted in cure were more likely to be found in the former patient group. Also more patients with a history of alcoholism and cigarette-smoking were represented in the group with adjunctive HBO-therapy. These patients generally show a worse compliance to therapy. Further the effects of cigarette-smoking can antagonize the effects of HBO-therapy¹⁷.

Patients who received adjunctive HBO-therapy experienced significantly less major surgical procedures (e.g. decortication, resection or extensive local revision) than patients without HBO-therapy, whereas more minor procedures (local incision and drainage and removal of the dental focus) were performed in the former group. This result is consistent with our experience, that in cases with limited extent of the disease, local rinsing, antibiotics and HBO-therapy are sufficient, hence avoiding decortication or resection.

In the medical and dental literature several different therapeutic HBO-modalities are discussed controversially. Aitasalo et al.⁵ concluded that a protocol including pre- and postoperative HBO sessions allows an overall reduction of the number of HBO sessions without adverse effect on the outcome of chronic osteomyelitis. This is consistent with our experience that combined HBO-therapy pre- and postoperative seemed to show the best outcome, whereas postoperative HBO-therapy alone was least beneficial. However the number of cases examined was too small to be conclusive on this question. Clinical and Laboratory data suggests that hyperbaric oxygen therapy clearly has a beneficial influence on the treatment of **Osteomyelitis**^{13,5, 8, 13,16}. Our study demonstrated that it may reduce the need for aggressive surgical therapy without negative influence on the outcome. However analysis of retrospective data is particularly difficult, especially in this disease because of the always inhomogeneous group of patients with different stages and extent of Osteomyelitis, as well as concomitant medical conditions influencing the course of the disease. These factors must also be taken into account for this study. Prospective randomized trials on a big population (multi-center) are necessary to collect more accurate data. This is a prerequisite to answer the questions: which patient benefits from adjunctive HBO-therapy and which doesn't and which is the most effective protocol for HBO-therapy? So far, for reasons mentioned above, as well as restrictions in health-care insurances covering HBO-therapy in many countries, no prospective randomized trials addressing this issue have been conducted. Hopefully this will change in the near future. We already know about the beneficial effect of HBO in the therapy of **Osteomyelitis** of the jaw. Let's take the next Step and establish a treatment protocol which will lead to satisfactory and reproducible results.

References

1. Haers PE, Grätz KW, Schenk B, Sailer HF. Hyperbaric oxygen therapy as an adjuvant in Maxillofacial Surgery, Joint Meeting on Diving and Hyperbaric Medicine - 3rd Swiss Symposium 1992
2. Marx RE, Johnson RP, Kline SN. Prevention of osteoradionecrosis : a randomised prospective clinical trial of hyperbaric oxygen versus penicillin. J Am Dent Assoc, Vol 111, July 1985: 49- 54 "
3. Jamil MU, Eckardt A, Franko W. Hyperbare Sauerstofftherapie. Klinische Anwendung in der Behandlung von Osteomyelitis, Osteoradionekrose und der Wiederherstellungschirurgie des vorbestrahlten Unterkiefers. Mund Kiefer GesichtsChir (2000) 4:320-32
4. Arcuri MR, Fridrich KL, Funk GF, Tabor MW, Lavelle WE. Titanium osseointegrated implants combined with hyperbaric oxygen therapy in previously irradiated mandibles. J Prosthet Dent 1997;77:177-83

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5. Aitasalo K, Niinikoski J, Greman R, Virolainen E. A modified protocol for early treatment of osteomyelitis and osteoradionecrosis of the mandible. *Head and Neck Vol 20,5,1998:411-417*
 6. Hart GB, Mainous EG. The treatment of radiation necrosis with hyperbaric oxygen. *Cancer 1976; 37:2580*
 7. Teixeira W, Muller W, Vuillemin T, Meyer E. Hyperbarer Sauerstoff in der Behandlung der Radioosteonekrose des Unterkiefers. *Laryngorhinootologie. 1991; 70: 380*
 8. Van Merkesteyn JP, Bakker DJ, Van der Waal I, Kusen GJ, Egyedi P, Van den Akker HP, De Man K, Panders AK, Lekkas KE. Hyperbaric oxygen treatment of chronic Osteomyelitis of the jaws. *Int J Oral Surg 1984 Oct;13(5):386-95*
 9. Goupil MT, Steed DL, Kolodny SC. Hyperbaric oxygen in the adjunctive treatment of chronic **Osteomyelitis** of the mandible: **report** of a case. *J Oral Surg 1978 Feb;36(2): 138-40*
 10. Evans BE, Jacobson JH 2nd, Pierce EC 2nd, Friedman EW, Schwartz AE. Chronic Osteomyelitis of the mandible: hyperbaric oxygen treatment. *NY State J Med 1976 Jun;76(6):966-7*
 11. Sippel HW, Nyberg CD, Alvis HJ. Hyperbaric oxygen as an adjunct to the treatment of chronic Osteomyelitis of the mandible. Report of a case. *Trans Int Conf Oral Surg 1973 ;4 :125-8*
 12. Mainous EG, Boyne BJ, Hart GB. Hyperbaric oxygen treatment of mandibular Osteomyelitis: report of three cases. *J Am Dent Assoc 1973; 35: 13*
 13. Calhoun JH, Cobos JA, Mader JT. Does hyperbaric oxygen have a place in the treatment of osteomyelitis? *Othop Clin North Am 1991 Jul;22(3):467-71.*
 14. Triplett RG, Branham GB, Gillmore JD, Lorber M. Experimental mandibular Osteomyelitis: therapeutic trials with hyperbaric oxygen. *J Oral Maxillofac Surg 1982 Oct; 40(10):640-6*
 15. Mader JT, Adams KR, Wallaece WR, Calhoun JH. Hyperbaric oxygen as adjunctive therapy for **Osteomyelitis**. *Infec Dis Clin North Am 1990 Sep;4(3):433-440*
 16. Marx RE, Johnson RP. Problem wounds in oral and Maxillofacial surgery: the role of hyperbaric oxygen. *In: Davis JC, Hunt TK, Ed: Problem Wounds: The role of oxygen. Elsevier. Amsterdam 1988.*
 17. Otto GH, Buyukcakir C, Fife CE. Effect of smoking on cost and duration of hyperbaric oxygen therapy for diabetic patients with non healing wounds. *Undersea Hyperb Med 2000 Summer, 27(2):83-9*

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