

Low Level Laser Therapy of Sinusitis

鼻竇炎的低能量雷射治療

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翻譯：康禾股份有限公司

出處：Laser World , [http:// www.laser.nu / lllt / lllt_editorial9.htm](http://www.laser.nu/lllt/lllt_editorial9.htm)

知識的獲得與分享得來不易，以下翻譯內容若有錯誤，煩請您多多指教更正。

ABSTRACT摘要

The authors have been monitoring influence of a therapeutic laser (LLLT), wavelength 830 nm, output 40 - 120 mW, on treatment of acute sinusitis in 194 patients in group I (consisting of 20 patients with diagnosis of sinusitis maxillaries unilat. bilateralism - 145, frontals unilat. - 2, pan sinusitis - 24 patients). Control group II consisted of 241 patients with the same diagnosis, treated without the use of a laser.

本文作者已觀察出低能量雷射療法的作用。

群組 1：為實驗組，使用波長 830nm，功率 40~120mW 之雷射，治療 194 位正發炎中的鼻竇炎患者。(其中 20 位是上頷單側鼻竇炎，145 位是上頷雙側鼻竇炎，2 位是前額單側鼻竇炎，24 位是前額雙側鼻竇炎)。

群組 2：為控制(對照)組，有 241 位經診斷與群組 1 同為鼻竇炎的患者，使用雷射以外之一般方法治療。

Energy density applied on children was 1.6 J/cm², 3 times every other day, on adults 2.5 J/cm², 5 times every other day on every affected sinus. Laser probe was applied externally on the skin of frontal wall of the sinus.

雷射治療(群組 1)時，小孩每隔 1 天、每天 3 次，使用能量密度 1.6 J/cm² 的雷射在每一個感染發炎的鼻竇上照射；成人則每隔 1 天、每天 5 次，使用能量密度 2.5 J/cm² 的雷射在每一個感染發炎的鼻竇上照射。雷射是直接碰觸在照射處的皮膚表面上使用。

30 patients were treated with laser only, 91 patients were treated with laser and anti-histaminic, 73 patients were treated with laser, antihistaminic and antibiotics. A significant analgetic effect of laser irradiation was noticed in all groups, the number of punctures decreased substantially in comparison with group II, presumably thanks to release of outlets of the sinus and improved drainage, the time of

treatment decreased significantly. No complications were noticed. Key words: acute sinusitis, LLLT, 830 nm

有 30 位患者只使用雷射治療(SET A)；

有 91 位患者使用雷射及抗組織胺同時治療(SET B)；

有 73 位患者則使用雷射、抗組織胺及抗生素同時治療(SET C)。

雷射光束在所有群組中都表現出很明顯的止痛作用，需接受穿刺引流手術的患者數量與群組 2 比較來看也大大地減少，推測應感謝鼻竇的聯外孔疏通了，增進且改善了排水功能。治療時間也明顯減少，而且沒有任何併發症發生。

INTRODUCTION簡介

Diagnosis sinusitis acute is one of common types of diseases in outpatient's medical practice, however it can cause patients severe problems. Majority of patients is mostly afraid of punctures, which have become for our population the most feared ambulatory intervention. Some patients just cannot be convinced, and it was their negative attitude that made us consider thoroughly another way how to help them.

鼻竇炎是在門診中常常診斷出一種疾病，然而它卻會引起患者們極嚴重的問題。大多數患者很害怕鼻竇穿刺引流手術，他們已成為醫生最害怕的流動族群。有些病人就是無法被說服，他們消極的態度促使我們認真考慮尋找其他可以幫助他們的方法。

Laser irradiation has biostimulative, anti-inflammatory, and analgetic effects. Laser irradiation especially affects cellular membranes, membrane canalculated and pumps, mitochondria, cytoskeleton, nociceptors, fibroblasts, lymphocytes, polymorphonuclears and Langerhans cells. (1)

雷射光束具有光生物刺激、抗發炎及止痛的作用。雷射光束特別可以影響細胞中的膜通透性及主動運輸作用、粒腺體、細胞骨架、痛覺感受器、纖維母細胞、淋巴球、多核型白血球細胞和蘭格罕細胞。

Irradiation of red lasers penetrates several millimetres into tissue, in infrared part of the spectrum the penetration goes up to several centimetres, usually 4 - 6 cm. This is a very advantageous fact for the treatment of sinusitis for laser irradiation can be applied externally.

紅光雷射光束可穿透進入組織數公釐，光譜中的紅外線部份，則可穿透到數公分深，通常是 4-6 cm。這種特性非常有利於醫生，能從外部使用雷射光束來進行鼻竇炎的治療。

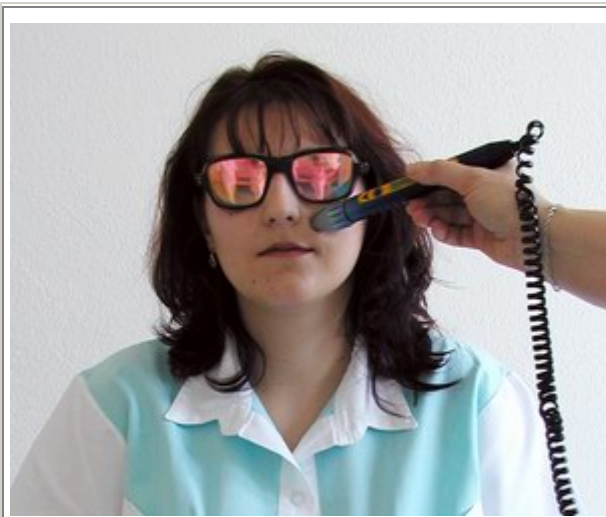
However, when applying a red laser it is necessary to introduce a light guide in the sinus. This appears to be the main reason why laser treatment of sinusitis in clinical ENT practice has been lagging behind, since at first we had had for a long time only He-Ne lasers at our disposal.

然而，當使用紅光雷射時，必需先放置一個光導引物進入鼻竇中，且從開始(應用雷射)到現在，我們有很長的一段時間只有唯一的一種 He-Ne 雷射可以使用，這似乎是為何鼻竇炎雷射治療在臨床 ENT 規範中的發展如此落後的主要理由。

INITIAL STUDY

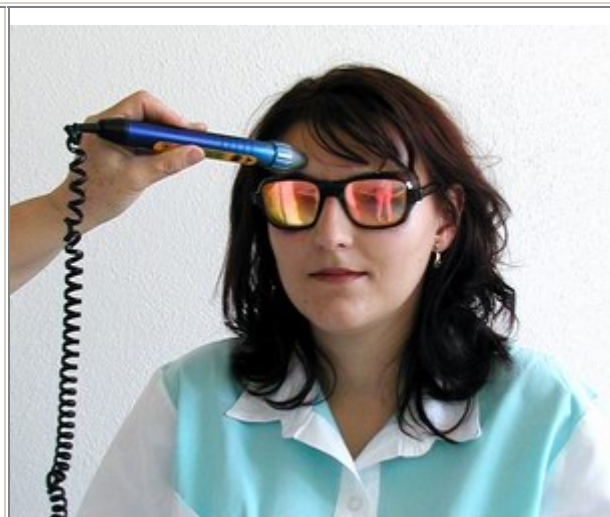
We have initiated laser treatment of sinusitis with a therapeutic diode laser with wavelength 830 nm, the beam of which penetrates more than 4 cm into tissue. With 40 and 80 mW output power we used continuous mode as well as pulsed frequency 9.12Hz.

我們已開始實施鼻竇炎的雷射治療，使用的是有療效的波長 830nm 二極體雷射，它的光束能穿透進入組織超過 4 公分深。輸出功率是 40 及 80mW 之連續波及 9.12Hz 脈衝波。



Picture 1a: Sinusitis maxillaries - points of irradiation

圖 1a. 上頤鼻竇之雷射照射點



Picture 1b: Sinusitis frontals - points of irradiation

圖 1b. 前額鼻竇之雷射照射點

We irradiated the whole area above the sinuses, children three times with energy density 1.6 J/cm² every other day on each sinus, adults five times with energy density 2.5 J/cm² every other day on each sinus.

我們在所有的鼻竇區域進行雷射照射，小孩每隔 1 天、每天 3 次，使用能量密度 1.6 J/cm² 的雷射在每個鼻竇進行照射；成人則每隔 1 天、每天 5 次，使用能量密度 2.5 J/cm² 的雷射進行照射。

Group I consisted of 223 patients with diagnosis of sinusitis acute with manifestations on maxillary sinuses, frontal sinuses and with pansinusitis.

群組 1 包含 223 位病人，皆是經過診斷證實為鼻竇炎，發炎位置為上頤鼻竇、前額鼻竇，以及泛發性鼻竇炎。

We rejected 29 patients due for their clear evaluation was not possible due to the following reasons: condition after a surgery on sinuses, relapsing sinusitis on a rugged chronic operation field, or polyposis. With these patients x-ray pictures after the therapy could only hardly be evaluated.

我們排除了 29 位病人進行研究，他們有以下症狀或情形，以致於不可能進行清楚的結果評估：鼻竇剛進行過外科手術、在長期不斷手術的凹凸不平區域上的復發性鼻竇炎、或是有息肉，這些患者(雷射)治療過後的 X 光片很難評估結果。

Furthermore, other patients with immune system disorders and patients on whom LLLT had not been applied since the beginning of the treatment were rejected.

Finally, one patient was rejected due to absence on his check up visit, too.

此外，其他還有一些免疫系統失調的患者，及沒有從鼻竇炎治療一開始就使用雷射配合治療的患者，也被排除在實驗之外。最後，有一位病人在面試時缺席，也被排除了。

For comparative evaluation a retrospective monitoring of group II was used, where no laser was applied. Group II consisted of 241 patients, followed in our office between January 1 and December 31, 1997.

為了比較數據變化，我們另外設計了一個沒有使用雷射治療的群組 2，以進行回顧觀察。群組 2 包含 241 位病人，由辦公室負責追蹤(從 1997 年 1/1~12/31)。

Criteria for putting on group II was identical with those of group I, our surgery was not equipped with a laser at that time. The parameters followed in groups I and II (data in brackets) are presented in Table 1.

群組 2 的挑選標準與群組 1 相同，但我們的診療室於治療同時並沒有裝置雷射。群組 1 及群組 2(括號內的數據)的參數呈現在 Table 1 中。

Table 1: Affection of individual sinuses 鼻竇個別感染的位置

Affection of sinuses	Unilateral	Bilateral
鼻竇感染種類	單側	雙側
Sinusitis maxillaries 上頷鼻竇炎	20 (97)	145 (108)
Sinusitis frontals 前額鼻竇炎	3 (3)	2 (2)
Pansinusitis 泛發性鼻竇炎	24 (31)	

In total 194 patients were evaluated in group I (69 children, 91 women, 34 men) with the age ranging from 4 to 70 years (Diagram 1), average age of adults was 43 years.

群組 1 的 194 位病人(69 位小孩，91 位成人女性，34 位成人男性)，年齡分佈為 4~70 歲，平均年齡為 43 歲。

In group II 241 patients were evaluated (71 children, 112 women, 58 men), age ranging from 5 to 83 years (see Diagram 1), average age 38,5 years.

群組 2 的 241 位病人(71 位小孩，112 位成人女性，58 位成人男性)，年齡分佈從 5~83 歲，平均年齡 38.5 歲。

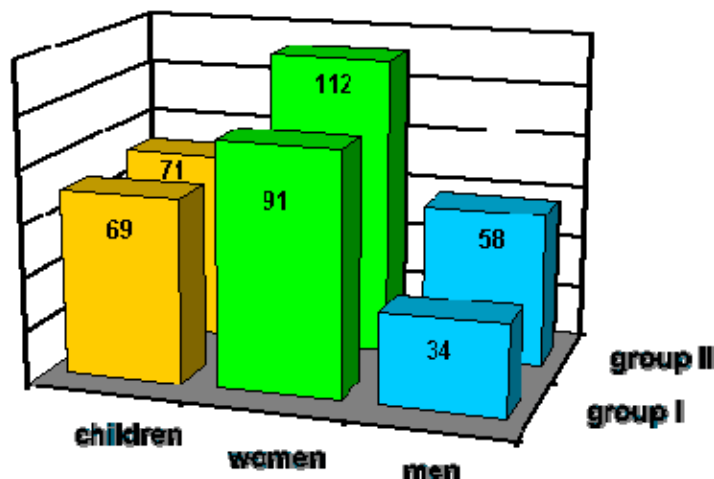


Diagram 1: Composition of groups I and II 群組 1 及群組 2 的年齡分布比較

Therapy was chosen in correspondence with the health condition of a patient and with regard to his/her clinical diagnosis, verified by a conventional x-ray picture of the sinuses.

All our patients had taken standard nasal anaemic drops even before determination of the diagnosis sinusitis acute.

治療方法是根據患者健康狀況及鼻竇 X 光片臨床診斷結果來選擇的。即使在經診斷判定為鼻竇炎之前，所有的病人都有使用標準的增進鼻部循環的藥。

On patients gathered in set A we applied laser (LLLT) only. Set B was treated with laser + antihistaminic (loratadine or cetirizine), set C with laser + antihistaminic + antibiotics (usually amoxilines only, or enriched with potassium clavulanate or cefalosporines,

病人分為三類進行治療，A 組我們只使用雷射治療。B 組使用雷射+抗組織胺(loratadine 或 cetirizine)治療。C 組我們使用雷射+抗組織胺+抗生素(通常只用 amoxilines，或是再加上 potassium clavulanate 或 cefalosporines)治療。

in the event of preceding adverse reaction to ATB we used quite extraordinarily macrolides or clindamycine) in accordance with experience of ENT specialists of University of Irvine, California (7). (See Table 2).

為了避免先前 ATB 逆反應事件的發生，我們依據加州大學爾凡分校 ENT 專家的經驗，使用了 macrolides 或 clindamycine。

Table 2: Group I 群組 1

Sinusitis acute 鼻竇炎種類	Set A -laser	Set B - laser + antihistaminic	Set C - laser + antihistaminic + ATB	Total	Patients with punctures
Catarrhal 鼻黏膜炎	26	56	21	103	1
Catarrhal 鼻黏膜炎+hyperplasic 增生	3	14	17	34	0
Homogeneous veil	0	16	23	39	9
Liquid level 液體等級	1	5	12	18	1
Total 總和	30	91	73	194	11

In group II set A (laser) was excluded, other groups received the same medication as in group I. (See Table 3)

群組 2 排除 A 組(使用雷射)，其他組別依群組 1 施行同樣的治療方式。

Table 3: Group II

Sinusitis acute	Set A - laser	Set B - laser + antihistaminic	Set C - laser + antihistaminic + ATB	Total	Patients with punctures
Catarrhal	0	44	52	96	11
Catarrhal + hyperplasic	0	17	40	57	18
Homogeneous veil	0	9	42	51	23
Liquid level	0	6	31	37	21
Total	0	76	165	241	73

Average length of treatment was set from determination of diagnosis till clinical physiological ENT finding. Three patients from monitored group suffered from sinusitis maxillaris acute twice in one year with 6 months interval, the group was monitored from December 1, 1998, till July 1, 2000, i.e. one and a half year in total.

平均治療完成時間的確定，是從臨床生理學的 ENT 診斷確定來決定的。有三個觀察組的病人在一年中有兩次(每六個月一次)就患上頂鼻竇炎所苦，這組病人觀察時間自 1998 年 12 月 1 日至 2000 年 7 月日，總共花了一年半的時間。

Table 4: Average length of treatment in days - group I 群組 1 的平均治療天數

Sinusitis acute	Set A - laser	Set B - laser + antihistaminic	Set C - laser + antihistaminic + ATB
Catarrhal	6.3	7.9	7.6
Catarrhal + hyperplasic	9.5	8.5	9
Homogeneous veil	0	10.5	9.5
Liquid level	8	7.8	9.4

All patients were always monitored in the first day of treatment (once in the course of therapy) and upon the day of termination of therapy, all patients presented themselves for an ENT check up 6 months after the termination of therapy.

所有的病人從治療開始的第一天(一次治療療程之中)到結束的最後一天，都接受紀錄觀察，且所有的病人在治療終止後 6 個月，再進行 ENT 檢查，以呈現他們自己現在的鼻竇狀況。

Upon termination of treatment control x-rays of sinuses of patients with homogeneous veil or of patients with the findings of liquid levels were taken, whilst control x-rays of patients with minor forms of sinusitis were taken only exceptionally. Average length of treatment in group II without LLLT application varied from 11.1 to 18.8 days.

Table 5: Average length of treatment in days - group II 群組 2 的平均治療時間

Sinusitis acute	Set A - laser	Set B - laser + antihistaminic	Set C - laser + antihistaminic + ATB
Catarrhal	0	11.1	12.4
Catarrhal + hyperplasic	0	12,3	13.6
Homogeneous veil	0	14.2	11.4
Liquid level	0	18.8	17.5

DISCUSSION 討論

Only few papers on laser treatment of sinusitis can be found in literature. Kruchinina et al. (2) irradiated catarrhal and purulent maxillary sinusitis, both acute and chronic in 120 children inpatients in the age of 6 to 15 years, with He-Ne laser. A light guide was inserted in the cavity by a drain, laser output power was 7mW/cm², irradiation time 3 - 6 minutes daily. Consolidation came after 5 - 9 applications. Prior to therapy immunological examination showed decreased sIgA in the secret of the cavity, however values increased significantly after the treatment.

在過去文獻中只能找到幾篇雷射治療鼻竇炎的論文。Kruchinina et al. (2) 用 He-Ne 雷射為 120 位 6~15 歲的住院兒童做治療，症狀為鼻黏膜炎及上頤鼻竇化膿，都是發炎且轉為慢性。使用鼻竇排水管將雷射導引物放入鼻竇排水孔中，雷射輸出功率為 7mW/cm²，每天治療 3~6 分鐘。症狀在 5-9 次治療之後好轉。在治療前做的免疫治療測試中，可發現鼻竇排水孔中 sIgA 量減少，然而治療後卻明顯增加許多。

Plouzhnikov et al. (3) consider LLLT of acute and chronic sinusitis an important part of a comprehensive medicine. They irradiate with He-Ne laser 10mW/cm² by a light guide inserted in the sinus through a puncture needle, 2 - 3 times on acute, and 5 - 9

times on chronic sinusitis. Energy density 2.1 - 8.4 J/cm² has anti-inflammatory, anti-oedematous and analgesic effects.

Plouzhnikov et al. (3)認為以下參數在使用複合醫學 LLLT 治療發炎化膿的鼻竇炎時是很重要的一部分。他們使用 10mW/cm² He-Ne 雷射，利用刺針穿刺方式，將雷射導引物置入鼻竇中。發炎部位做 2-3 次治療，化膿部位做 5-9 次治療。能量密度為 2.1-8.4 J/cm²，有消炎、消腫及止痛的作用。

Prazak (4) uses a semiconductor laser 830 nm. In case of an acute frontal sinusitis he applies 3 J/cm² on the area of foramen supraorbitale, and on another two frontal points of metopatron 1.5 J/cm² on each. In case of inflammation of gnathic sinus he irradiates the area of foramen infraorbitale by 3 J/cm², and the areas of fossa canina a processus zygomaticus by 2 J/cm². Simultaneously, he administers antipyretics, or antibiotics per os. LLLT decreases subjective complaints, especially headaches. He irradiates every day till consolidation, on chronic sinusitis 8 - 10 applications every other day.

Prazak (4)使用 830nm 半導體雷射，一例治療前額鼻竇發炎，他提供 3 J/cm² 在眼窩上方區域，以及 1.5 J/cm² 在兩個前額的額竇點上。一例顎竇發炎，他使用 3 J/cm² 照射眼窩內側排水孔，及 2 J/cm² 從犬齒窩照射顴突。同時，他使用退熱劑，或抗生素在以上的每塊治療處的骨頭上。LLLT 減少病患的主觀症狀，尤其是頭痛。他每隔一天照射鼻竇炎處，直到症狀穩定，約 8-10 個療程。

Moustsen (5) with a group of colleagues from Aarhus University conducted a double blind randomised study in 60 patients, on whom they applied laser irradiation of 30 mW, 830 nm, for 90 seconds, in three sessions on each sinus in 1 - 3 days interval. They found no statistically important difference between laser and placebo as far as pain feeling, disease duration, nor overall condition are concerned.

Moustsen (5)的 Aarhus University 研究團隊針對 60 位患者設計了一個雙盲隨機研究。他們使用 830nm 30mW 雷射，每次照射 90 秒，間隔 1-3 天，在三學期中照射每一個鼻竇位置。

Simunovic (6) presents in the chapter "LLLT in ENT" treatment of sinusitis with a diode IR laser. He recommended energy density 2 - 4 J/cm² on mucous inflammations. Compared to other specialties, the chapter devoted to ENT is unusually brief - 3 pages of text only.

Simunovic (6)在"LLLT in ENT"的一個章節中，發表了一種使用紅外線二極體雷射的療法。他建議使用劑量 2-4J/cm² 在發炎的黏膜上。與其它特色比較，這章節專門寫 ENT 的部份不尋常地短，只有三頁。

Therapy of sinusitis is focussed on suppressing infection, influencing unpleasant symptoms - especially pain, shortening duration of disease, preventing relapses and

transformation into chronic phases of the disease. These were our main concerns when monitoring the influence of laser irradiation on sinusitis.

鼻竇炎的治療方式要鎖定在抑制發炎感染上及影響討厭的症狀-尤其是痛，縮短好轉時間，避免復發及轉移成慢性疾患。這是我們在觀察使用雷射於鼻竇炎上時最主要關心的作用。

1. We can quite unambiguously confirm a positive effect of laser on diminishing pain. In all monitored sets a relief of pressure and pain was noticed within 24 hours after the first irradiation in group I.

1.我們可以非常明確地確認，雷射對於減輕疼痛的正向作用。在群組 1 中，可以觀察到所有人的疼痛感及壓迫感在第一次進行雷射治療的 24 小時內都得到了舒緩。

2. In therapy of sinusitis it is important to attain re-ventilation of the cavity and functional mucocilliar transportation of the secretion, depending on interaction of the mucus and function of cilia.

2.在鼻竇炎的治療中有一些重點必須要達成，就是要再次疏通排水孔及恢復排除分泌物的纖毛運動之功能。

Significant decrease of number of patients, who had to undergo a puncture, bears witness to an influence of laser irradiation on release of outlets of sines and restoration of mucocilliar transportation. In gnathic and metopic sines the transportation is circular and it is directed by determined drainage paths, leading to natural sinusal outlets. The transportation ceases due to various reasons - toxins, medicaments, temperature, and relation between liquid and viscose layers of the mucus, surfactants, or bilateral contact of the surface of the mucose, especially in the area of the outlets.

必須忍受穿刺引流的病人數量的減少是很有意義的，數量下跌的依據是雷射照射疏通了鼻竇的排水孔，而且重建了纖毛運動的清除作用。在上額及下頂的鼻竇中，轉移作用是透過天然的排水孔引導而相互循環的。轉移作用的停止有許多種原因，毒素，藥劑，溫度，以及液體及粘液層，表面活性，兩邊黏膜表面的雙向溝通等等，特別是在出水孔的區域附近。

Most punctures, 8 of total 11 monitored patients with punctures in our group I, were performed in the category with homogenous obscure of the sines treated with laser and antihistaminic (set B), whilst only one of 29 patients in the category with homogenous obscure of the sinuses had to undergo punctures when treated with laser + antihistaminic + antibiotics (set C).

大部分的穿刺引流，在群組 1 中，set B(使用雷射及抗組織胺治療)總共有 11 位病人進行穿刺引流，其中有 8 位執行了 category with homogenous obscure of the sinuses，set C(使用雷射+抗組織胺+抗生素)總共有 29 位進行了穿刺引流，其中只有一位又執行了 category with homogenous obscure of the sinuses。

Puncture emphysema in set B was both blennioid and purulent. The number of patients with punctures in group II was also highest in the group with homogenous obscure - 23 patients (neither number of punctures, nor laterality was not taken into account). Laser irradiation is expected to bring a positive influence due to its anti-inflammatory and anti-oedema tic effects especially in the area of the outlets. In the case of a homogenous obscure quantity, composition, and pressure of the mucus substantially impairs mucociliar transportation and, furthermore, the mucus prevents penetration of laser irradiation. Addition of antibiotics may contribute to a quicker elimination of inflammation.

在 SET B 中，穿刺造成的氣腫會像黏魚般化膿。群組 2 中有 homogenous obscure 的患者接受穿刺引流的數量也是非常高，有 23 人(不是穿刺的人數，也沒有將單側穿刺的數量計算進來)。雷射照射預期會對抗發炎及抗水腫痙攣影響帶來正向的作用。尤其在排水孔附近區域。在一個案例中，homogenous obscure 的量，組成，及黏液的壓力都大大地減少了粘膜炎的轉移，且再者，粘膜炎防止了雷射照射的穿透。加入抗生素可以快速去除發炎症狀。

3. Acute rhinogenous sinusitis is usually primarily viral, with secondary bacterial super infection. According to our experience (8) laser irradiation has no bactericidal effect, however it causes reduction of cytopatogenous effect of herpes simplex virus, and the same effect can be presumed on other viruses. However, laser irradiation substantially stimulates non-specific as well as specific immune actions - it increases lysozyma in saliva, increases phagocyte activity, stimulates T and B lymphocytes and thus it through immunostimulation significantly contributes to healing processes.

發炎的慢性鼻竇炎通常是先由病毒引起的，次要則是由細菌做超級感染造成。根據我們的經驗(8)，laser 照射沒有殺菌作用，然而它卻可以導致 herpes simplex 病毒的 cytopatogenous 作用的減少，並且假設同樣的反應可能被作用在其它病毒上。然而，laser 光束也大大地促進了特定及非特定免疫活動，它增加唾液中的 lysozyma，增加巨噬細胞活動力，刺激 T 及 B 淋巴細胞，對治療程序有很大的貢獻。

4. All patients in group I were clinically checked up after six months. Patients with homogenous obscure of the sines or with levels were x-ray screened before and after therapy. It was not necessary to hospitalise any patient, nor had any patient complications nor relapses within six months after therapy. No symptoms of chronic sinusitis were noticed.

群組 1 中所有的患者在六個月後都做了臨床檢查。患者有 homogenous obscure 鼻竇或以 X 光在療法前後進行篩選。沒有任何患者需要再送醫院，也沒有症狀複雜化，亦沒有人復發。沒有任何慢性鼻竇炎的症狀被檢查到。

Average duration of therapy varied between 6.3 to 10.5 days in group I (with LLLT), average duration of therapy in group II (without the use of laser) ranged from 11.1 to 18.8 days.

群組 1(使用 LLLT 治療)中，療程的平均持續時間約在 6.3~10.5 天之間。群組 2 中(沒有使用 LLLT 治療)，療程的平均持續期範圍則是從 11.1~18.8 天。

We are of the opinion that negative evaluation by Moustsen et al. (5) may be influenced by short application time.

CONCLUSIONS結論

LLLT irradiation is a benefit for treatment of acute sinusitis. External irradiation with a laser with 830 nm wavelength, enabling the beam to penetrate 4 - 6 cm deep is recommended. Irradiation with red light emitting lasers is also effective, but due to the need of application through a light guide inserted into the cavity this method has been already discarded from clinical practice.

LLLT 雷射照射療法對於治療鼻竇炎有很好的幫助。由外部照射 830nm 波長的雷射，光束可以穿透進入 4~6 公分深。紅光雷射也是有效的，但是要先將雷射導引物置入孔中才可有效照射，相信這個方法在臨床測試時已經被捨棄了吧。

Laser irradiation works through its analgetic, anti-inflammatory and biostimulative effects on ease of pain, or even on its elimination, its also causes a quicker withdrawal of inflammation and oedema of the mucose and thus brings restoration of drainage of sines as well as normalisation of mucociliar function.

雷射照射會有效果，來自於它的止痛，抗發炎，及緩和疼痛的生物刺激效應。它並且能導致鼻竇發炎及腫脹的症狀快速消退，恢復鼻竇的排水功能並且使 mucociliar 的作用正常化。

Immunomodulative effect - improvement of both specific and non-specific immunities by stimulation of T and B lymphocytes,

Immunomodulative 作用- 刺激 T 和 B 淋巴細胞的作用，使特定和非特定免疫作用改善。

lysozyme and phagocytosis - is also significant. Stimulation of Langerhans cells of the mucose of sines is presumed, too.

溶菌酶作用和吞噬作用-也是值得注意的地方。此處也是假設雷射可以刺激鼻竇黏膜中的蘭格罕細胞進行免疫反應。

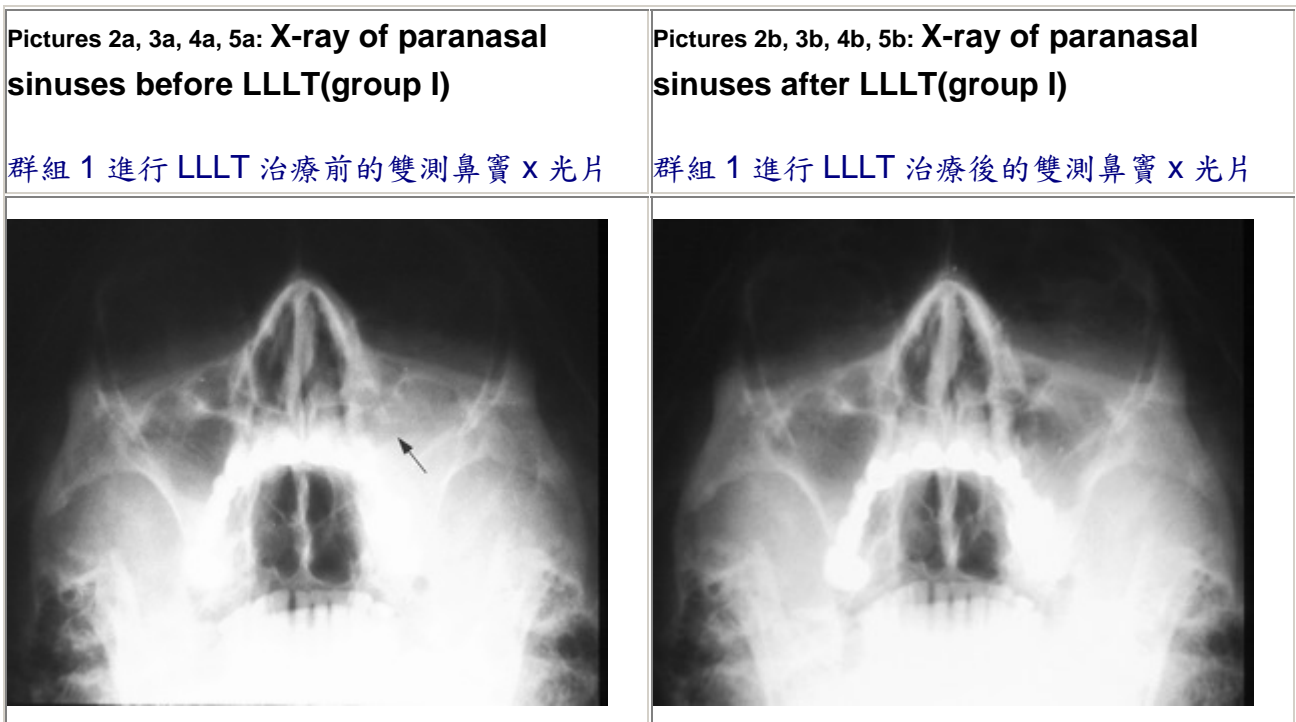
Laser irradiation in treatment of sinusitis has no contraindications (with the exception of general contraindications, i.e. malignant tumours in the irradiation area, or epilepsy), and as a physiotherapy it can suitably complement therapy with antibiotics, mucolytics, and antihistaminic.

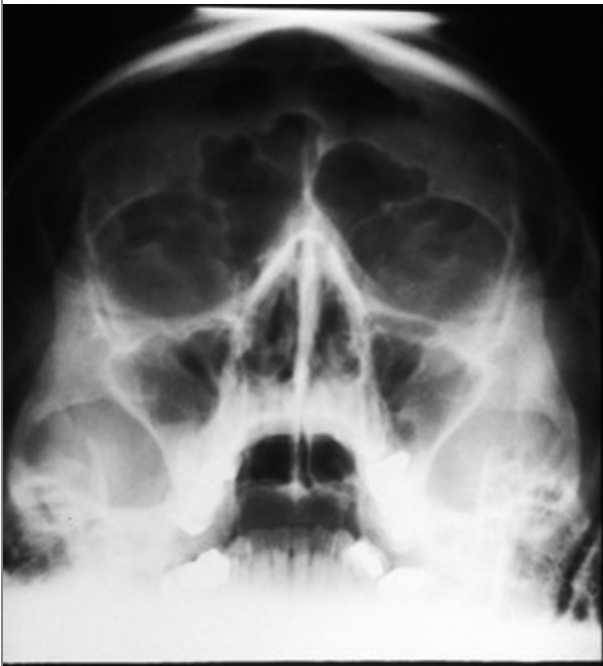
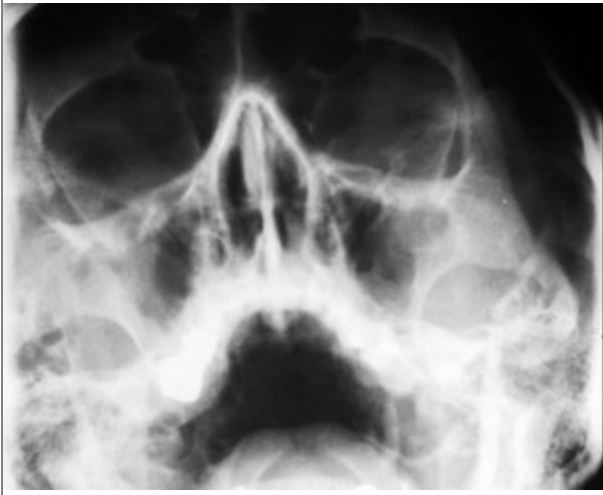
雷射在治療鼻竇炎時沒有什麼禁忌症(只有兩個一般性的禁忌症，就是要避開惡性腫瘤及癩癩)，而且以視為一種物理療法來看，它可以同時與抗生素，去痰劑或是抗組織胺劑的療法合併同時使用。

The use of laser with 830 nm wavelength appears to be the most beneficiary on diagnosis sinusitis acute with liquid levels in paranasal sinuses, the treatment of which was cut down by 59 per cent in average, and on a group of patients with plain catarrhal obscure and decreased transparency (the most frequent) where duration of therapy was shortened by 39 per cent. 830nm 波長雷射用於治療成對發炎之鼻竇炎功效最佳，治療過程平均縮短 59%，一組患有 plain catarrhal obscure and decreased transparency (the most frequent) 的患者，治療過程則平均縮短 39%。

Total number of patients with punctures was cut down by about six times when using LLLT simultaneously.

需進行穿刺患者的數量，於使用 LLLT 治療時，則大大地減少了約 6 倍。





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