African Journal of

Biotechnology

5 November 2008 Vol. 7 No. 21

African Journal of Biotechnology Vol. 7 (21), pp. xxxx-xxxx, 5 November, 2008
Available online at http://www.academicjournals.org/AJB
ISSN 1684–5315 © 2008 Academic Journals

Full Length Research Paper

Application of an antibacterial dressing spray in the prevention of post-operative infection in oral cancer patients: A phase 1 clinical trial

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Accepted 8 October, 2008

This study investigates the effects on the prevention of oral infection after operation in oral region by using an antibacterial dressing spray (JUC spray). 60 patients diagnosed with grade 1 and 2 of oral squamous cell cancinoma, and the conservation surgery had applied to them under general anesthesia. Half of these patients were treated with JUC and the rest accepted traditional method. The complete blood picture (CBP) and the growth of bacteria in the wound were analyzed. The average wound healing time in JUC group was significantly shorter than that in the control group. The amount of bacteria presented in wound was lower in JUC group than that in the traditional group. There was no significant difference between the CBP of the two groups. The JUC antibacterial dressing spray, after spraying on the surface of the wound formed a layer of physically antibacterial molecular film to prevent the growth of bacteria and effectively reduced the average wound healing time.

Key words: Antibacterial dressing spray, oral squamous cell cancinoma, wound healing, infection.

INTRODUCTION

Oral cavity interlinks with respiratory tracts and digestive tracts. After surgery in these tracts, aerobic and anaerobic bacteria frequently induce operative wound infections in teeth, periodontal and supporting tissues of the teeth and tonsils (Senpuku et al., 2002, 2006; Salam et al., 2001). It is found that these infected areas generally have beneficial environment for bacterial proliferation; suitable temperature and humidity, which account for the frequent infections.

In general, infections are commonly found in oral cancer patients after surgical excision of the tumor (Senpuku et al., 2003, 2006; Tada, 2002a, b). This might be due to wound exposure during and after the operation, even if sutured, which micro-organisms may infect oral regions, oropharynx, nasal cavity, and paranasal sinuses areas. Patients after oral cavity surgery often appear to have complications after bacterial infections, as well. Colonization of pathogenic bacteria in oral cavity is thought to increase the risk of infections such as pneumonia and bacteraemia (Costerton et al., 1999; Gosney et al, 1999). It is therefore of high importance to prevent from or cure for the infections.

Currently, the systemic applications of antibacterial drugs have shown better results on curing diseases than local application, which could induce drug-resistant bacteria in the particular area (Belusic-Gobic et al., 2007; Cloke et al., 2004). In this study, however, JUC physical antimicrobial dressing was applied to some specific areas on oral cancer patients after surgery to prove the new physical antimicrobial method, which will not lead to the production of drug resistant bacteria, while preventing infections.

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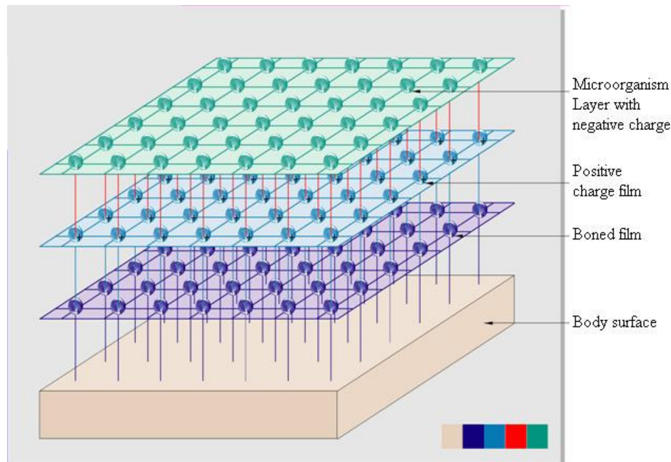

Figure 1. The mechanisms of anti-microbial effect of JUC.

MATERIALS AND METHODS

The mechanisms of anti-microbial effect of JUC and its quality control test

JUC, produced by NMS Technologies Company (Nanjing, China), consists of macromolecular active agent, a newly-invented product with a long-acting anti-microbial material. When water-soluble liquid of JUC is sprayed on skin surface or mucosal area, it immediately solidifies and forms an invisible anti-microbial layer with dual overlapping structure: the bonded film and the positive charge film, as shown in Figure 1. The bonded film is composed of macromolecular, securely boned to the body surface in form of chemical bonds. As a result of that, the bonded film has the function of long-acting effect to prevent microbial from growing. On the other hand, the positive charge film is composed of cationic activators to form a reticulate film with positive charge on the skin surface or mucosal area. The positive film has a very strong absorption of the pathogenic microorganism with negative charge, such as bacteria, fungi, and viruses. Therefore these pathogenic microorganisms will die of suffocation due to the fact that the respiratory enzyme in which they rely for existence is out of action, and hence, the positive charge film has the function of killing or inhibiting microorganism physically.

This product had been tested by Food and Drug Analytical Services Limited (Approval no: 9083481,USA) on the bactericidal results against *Acinetobacter baumanii* on a range of surfaces. JUC had passed all the tests on floor surface, metal handle surface, perspex surface, plastic handle surface, and steel surface. Also, JUC had been tested by The University of New Brunswick (CE approval No: 153038905) on the zeta potential and hydrodynamic size of the dress sample. JUC demonstrated high Zeta-potential values over a broad range of pH and the hydrodynamic size of the sample was 2.57 nm in 0.5% aqueous solution.

Clinical data

Sixty patients diagnosed with oral squamous cell carcinoma participated in the study from November 2004 to December 2006. They were recruited from Nanjing Stomatological Hospital, Nanjing University. There were 48 males and 12 females, and had an average age of 46.5, ranging from 32 to 63 (Table 1). These patients were randomly divided into two groups; the JUC or the control group, with 30 patients each. In the JUC group, there were 18 males and 12 females, with age range of 32 to 63. In the control group, there were 15 males and 15 females, with age range of 33 to 58. Signed consent forms were obtained from all patients and this study protocol was approved by the ethics committee board of the Nanjing Scientific Project (Funding number: 200504019).

Cases Inclusion and Exclusion Criteria

All patients being chosen to accept the either therapies had oral tumor at primary site and had never received any therapies, e.g. chemotherapy, biotherapy and radiotherapy. These patients who recruited in the study fulfilled the following: 1) completed medical records from patients; 2) free from systemic diseases; 3) did not accept any other treatments or being treated by any other ways.

Treatment Method

After oral region surgery, patients accepted 500 mg (qid) of oral amoxicillin and 600 mg (tid) of oral clindamycin (Martin et al., 2005) for preventive use. For the JUC group, JUC physical antimicrobial dressing (30 ml/bottle) was then applied to the oral, oropharynx, nasal cavity, and the neck areas every day after the operation. The amount of JUC physical antimicrobial dressing applied every time was 0.1 ml, three times a day, until the operative wound was healed over. For the control group, the operative wound was treated with standard medical caring and cleansing of wound using cotton soaked with 0.9% sodium chloride, three times a day.

Evaluation Standard of wound appearances and healing

After operation, the physical appearances of the wound healing were observed. Measurements included degree of redness, swollen, pain, secondary bleed, and inflammatory exudates. These measurements were expressed using the behavioral rating scales, where different levels to indicate different conditions. 0 represented no observable abnormality; 1-3 represented some abnormality; 4-5 represented obvious abnormality.

The number of days needed and the conditions for wound healing were noted. Time for healing was expressed in days while the conditions of healing were expressed in a three-grading system. Grade 1 healing indicated well healing of wound with the no reactions such as pain (0-3 degree), swelling in suture site, and inflammations. Grade 2 healing indicated wound with the reactions such as pain (4-6 degree), swelling outside suture area, and inflammations. Grade 3 healing indicated pain (7-10 degree), swelling with pus, and inflammations on wound.

Blood, renal and liver functions tests

Blood test for complete blood picture (Sysmex, KN-21, Japan), renal and liver functions tests (COBAS, INEGRA 400 Plus, Roche, Germany) were done pre-operation, one and three days after the surgery.

Sample collection and bacterial cultivation

Bacteria were collected on day 2 from the areas of skin or mucous membrane by using sterilized cotton swabs. After wetting, the cotton swab was immediately put into an air-tight sterilized test tube. To collect anaerobic bacteria samples, syringe was used to collect fluid under the deep area of the incision. Collected samples were immediately put into an anaerobic sample collection flask for cultivations.

Table 1. Characteristics of subjects.

Parameters	Patients Number and references values (n=60)
Age	46.5 (range: 32-63)
Sex	48 Male12 Female
Tumor position	48% in tongue52% in floor of mouth
Tumour type	Squamous cell carcinoma
T1-T2 N_0,M_0	60
Grade 1 surgery excises ≦ 2 mm	60

T, tumour; N, nodes; and M, metastases.

Table 2. Grades of healing after tumor excision by using JUC or traditional methods.

Grade of Healing	JUC group (n=30)	Control Group (n=30)
1	26*	22
2	4*	8
3	0	0

*Indicates statistical significant (p<0.05) between two group.

Table 3. Wound healing time after tumor excision by using JUC or traditional methods.

	JUC group (n=30)	Control Group (n=30)
Average Wound Healing Time	*8.97 ± 1.22 days	9.74 ±1.32 days

*Indicates statistical significant (p<0.05) between two group.

Statistical analysis

Statistical analyses were done using SPSS 15.0 (SPSS Inc., U.S.A.) and any differences at $p<0.05$ level were considered as statistically significant. The grading evaluation of symptoms and healing for control and patient groups were analyzed with chi-squared test to access statistical significance. All parameters of samples of both groups were compared using independent student t-test.

RESULTS

Physical appearance of wounds

Among all 60 patients from both groups, all received conservation surgery of the oral cavity. Among these cancer patients, their physical signs showed that values were within normal range after excision. Swelling of wound was reduced three to five days after surgery in JUC group. Their body temperature range was 37.8-38.8 with mild fever for the first 2 days after surgery.

Healing of wounds

For all patients, none of them had grade 3 healing. The numbers of grade 1 and grade 2 healing patients presented in the JUC group were more than that in the control group with significant differences ($p<0.05$) (Table 2).

Time of wound healing

The healing time for patients who applied JUC was shorter than that of patients in the control group, who received traditional methods. The JUC group had wound healed in 8.97 days while it required 9.74 days for wound healing in the control group (Table 3).

For patients who received JUC physical antimicrobial dressing and patients who had received traditional oral administrative drug, all of them did not present with any side effects.

Hematological, renal and liver functions analysis before and after treatments

The blood, kidney and liver functions assay, did not show any significant differences between and after treatment for both groups which received JUC physical antimicrobial dressing or traditional oral care methods ($p>0.05$) (Tables 4 and 5)

Bacteriology analysis

No obvious bacteria was cultured from skin or mucosal areas. Fifty samples suctioned from the incision beneath showed bacteria growth. *Streptococcus, Staphylococcus, Veillonella, Neisseria, and Actinomyces* were found mostly in the wound. For *Streptococcus, Staphylococcus, and Neisseria* there were significant differences ($p<0.05$) in amount between both groups (Table 6). In JUC group, the amount of *Streptococcus, Staphylococcus, and Neisseria* were significantly lower than that of the control group using traditional oral care methods. For *Veillonella* and *Actinomyces*, no significant differences were shown between the two groups (Table 6).

Table 4. Blood picture of white and red cells for both groups receiving JUC or traditional oral-caring methods (control) on days 0, 1 and 3.

Parameter	Unit	Normal Range	Day 0		Day 1		Day 3	
			Control	JUC	Control	JUC	Control	JUC
White blood cell	x10^9/L	4.00-11.00	6.2 ± 2.5	5.7 ± 2.8	10.8 ± 1.57	11.9 ± 1.8	7.4 ± 3.2	7.8 ± 4.0
Granulocytes	x10^9/L	0.2-1.30	0.4 ± 0.33	0.4 ± 0.46	0.8 ± 0.26	0.9 ± 0.18	0.6 ± 0.32	0.64 ± 0.41
Lymphocytes	x10^9/L	1.50-4.00	1.25 ± 0.89	1.0 ± 1.3	1.85 ± 2.0	1.84 ± 2.2	1.86 ± 1.13	1.86 ± 1.3
Hemoglobin	g/L	115-165	140 ± 22	138 ± 34	140 ± 27	168 ± 28.9	135 ± 36	190 ± 33
Platelet	x10^9/L	150-400	142 ± 35	122 ± 42	135 ± 41	146 ± 50	125 ± 48	170 ± 152

Data are presented as mean ± 95% confidence interval (95% CI).

Table 5. Renal and Kidney functions tests for both groups received JUC or traditional oral-caring (control) methods on days 0, 1 and 3.

Parameter	Unit	Normal Range	Day 0		Day 1		Day 3	
			JUC	Control	JUC	Control	JUC	Control
SGOT/ALT	U/L	5-31	30 ± 0.5	28 ± 0.23	30 ± 7.0	29.5 ± 7.8	28 ± 10.5	26 ± 3.5
SGPT/ALT	U/L	12-28	24 ± 1.0	25 ± 0.98	26 ± 0.45	28 ± 0.76	27 ± 0.45	24 ± 1.36
Albumin	g/L	42-54	40 ± 3.0	41 ± 3.2	38 ± 4.4	40 ± 5.4	37 ± 6.4	40 ± 5.8
GLB	g/L	20-30	24 ± 3.0	23 ± 3.5	22 ± 4.6	26 ± 5.0	20 ± 6.8	22 ± 7.6
Bilirubin	umol/L	7-19	5.6 ± 1.8	6.1 ± 1.48	8.7 ± 2.4	6.5 ± 2.8	5.6 ± 3.8	4.9 ± 3.5
Creatinine	umol/L	44-106	96 ± 11	97 ± 10	86 ± 13	96 ± 9.5	94 ± 8.8	84 ± 9.6

Data are presented as mean ± 95% confidence interval (95% CI).

Table 6. Bacterial growth inside incision after surgical excision.

Bacteria	JUC Group (n=28)		Control Group (n=22)	
	No. of positive cases	Percentage	No. of positive cases	Percentage
Streptococcus	8	28.6%	13	59.1%*
Staphylococcus	9	32.1%	14	63.6%*
Veillonella	10	35.7%	10	45.5%
Neisseria	7	25.0%	12	54.5%*
Actinomyces	9	32.1%	12	54.5%

*There were significant differences between the two groups ($p<0.05$).

DISCUSSION

Patients with tumors are easily affected with bacterial infections. They may have poorer immunity, malnutrition, anemia, and they appear to be weaker than before. During the development of tumor, the tumor cells or soluble products produced by tumor cells inactivate lymphocytes and provoke immunosuppression in the body (Bennett et al., 1996; Camp et al., 1996; Gimmi et al, 1996; Jewett et al., 2006; Mulder et al, 1996). Nevertheless, anti-tumor drugs used in tumor treatment will also lead to immune and bone marrow suppression. Therefore, infections can therefore occur at both operated (Senpuku et al., 2003, 2006; Tada et al., 2002a, b) and non-operated sites (Angele and Faist, 2002; Götzinger et al., 1996; Tedder et al., 1994; Yehia et al., 2004) and any small cuts in daily lives can bring tumor patients life-threaten infections. A long operation time in oral cavity raises the chances of bacterial infections (Angele and Faist, 2002; Götzinger et al., 1996). Therefore, effective preventive measures are necessary to protect the patients.

Nowadays, antimicrobial drugs have been very helpful to prevent infections after surgery. People, however, sometimes misuse them and have antimicrobial drugs abuse. The abuse of antimicrobial drugs brings severe adverse effects to people, for example, allergy, toxic reaction, and opportunistic infections (Senpuku et al., 2006). As a result, a new and ideal preventive method is needed for people who have surgery to reduce the chances of bacterial infections.

JUC physical antimicrobial dressing is a newly-invented treatment for patients who have had surgery (NMS Technologies Company Nanjing, China). It is made up of organosilicon quaternary ammonium salt, and a

water-soluble liquid of macromolecular active spraying agent. These form a positive film, attracting the negatively charged microorganisms. These microorganisms will die and are impossible to exchange materials, which lead to physical antimicrobial purpose. The JUC physical antimicrobial dressing is a good method which will not lead to the production of drug resistant bacteria, and it also gives a new way to help prevent bacterial infections.

The result of the experiment revealed that using the JUC physical antimicrobial dressing caused no serious adverse stimulations to the patients. All patients had good healing progress with no grade 3 healings but while using JUC physical antimicrobial dressing, the number of grade 1 and grade 2 wound healing increased and the average healing time required was shortened ($p<0.05$), which was significantly shorter than the group using traditional oral caring methods. For the analysis of blood parameters, kidney and liver functions, there were no significant differences between the groups using JUC or traditional oral caring methods ($p>0.05$). This indicated that application of JUC did not cause any significant side effects to the body; being the same as using traditional oral caring methods. On the other hand, JUC had a better inhibition effect on the growth of anaerobes than traditional oral caring methods ($p<0.05$) in which these anaerobic bacteria grew under the incision were those which possibly cause infections to the wound.

During application of JUC physical antimicrobial dressing, special care should be made since oral and maxillofacial are very complex structures with lots of saliva secretions. It is suggested that before application of JUC, spraying of dressing should be evenly distributed onto the whole surface of the incision right after cleaning of the incision such that the positive film can be formed and should cover the whole surface of the incision, hence, facilitating the healing of wounds. If sutures have to be taken out after healing, it can be done simply by removing the thin film of dressing and re-spraying JUC onto the surface of the incision after the removal of suture.

In conclusion, application of JUC physical antimicrobial dressing had beneficial effects over traditional oral caring methods. JUC shortened the healing of wounds by inhibiting the growth of some anaerobic bacteria without bringing any significant side effects. This easy-to-use treatment to prevent bacterial infection could be applied to patients after oral and maxillofacial tumor removal surgery.

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抗菌敷料喷雾剂在口腔癌瘤术创感染预防性应用：1 期临床试验

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收于 2008 年 10 月 8 日

本试验研究了在口腔肿瘤术后应用抗细菌敷料喷雾剂(洁悠神喷雾剂)，观察其预防口腔感染的效果。60 例患者确诊患有 1 级和 2 级口腔鳞状细胞癌，在实施全身麻醉后接受了功能保全手术。30 例用洁悠神治疗，其余 30 例用传统方法治疗。分析全血像和伤口处细菌的生长。平均术创愈合时间方面，洁悠神治疗组明显短于传统方法治疗组。伤口细菌量方面，洁悠神治疗组少于传统治疗组。两组患者的全血像无显著性差异。洁悠神抗菌敷料喷雾剂，喷洒于伤口表面后，形成一层分子级物理抗菌膜，可预防细菌生长，有效地降低平均术创愈合时间。

关键词：洁悠神长效抗菌材料，口腔鳞状细胞癌，术创愈合，感染

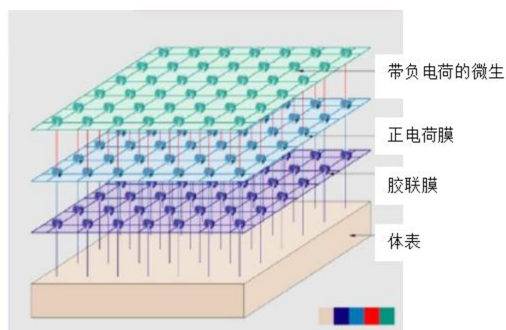
引言

口腔与呼吸道和消化道相通。在这些腔道进行手术后，需氧和厌氧细菌会不断引起牙齿、牙周组织和牙齿支持组织、扁桃体等的术创感染（Senpuku等人，2002，2006；Salam 等人，2001）。研究发现这些受感染的区域通常有细菌生长繁殖的适宜环境——适宜的温度、湿度，这是反复感染的原因。

一般来说，感染多见于肿瘤切除术后的口腔癌瘤术患者身上（Senpuku 等人，2003，2006；Tada,2002a, b）。这可能是由于术中、术后的伤口外露，即使进行了缝合，微生物也会感染口腔、口咽、鼻腔和鼻窦腔隙部位。患者进行口腔手术后常出现细菌感染造成的并发症。口腔内致病菌的定植通常被认为是感染风险增加的原因，比如：肺炎和菌血症（Costerton 等人，1999; Gosney 等人，1999）。因此，预防或治愈感染极其重要。

目前，抗菌药物的全身应用在治疗疾病上的效果优于局部应用，但这也是造成局部区域出现耐药菌的原因 (Belusic-Gobic 等人，20 07; Cloke 等人，2004)。然而，在本研究中，洁悠神物理抗菌敷料应用于口腔癌瘤术后患者身上的某些特定区域，证实这种创新的物理抗菌方法起到了预防感染的作用，同时没有耐药菌产生。

图 1 洁悠神的抗菌功效机理



材料与方法

洁悠神抗菌功效机理及其质量控制测试

南京神奇科技开发有限公司（中国南京）生产的洁悠神，其成分为高分子活性剂，是一种新开发的长效抗菌材料产品。当洁悠神水溶性制剂喷洒于皮肤表面或粘膜区时，快速固化后形成一层结构为复式叠加的隐形抗菌层：胶联膜和正电荷膜，见图1。胶联膜成分为高分子，以化学键方式与体表牢固连接。因此胶联膜具长时效预防细菌生长的功效。另一方面，正电荷膜成分为阳离子活性剂，在皮肤表面或粘膜区形成正电荷网状膜。正电荷膜对带有负电荷的病原微生物（细菌、真菌、病毒）具有强力吸附作用，致使其赖以生存的呼吸酶失去作用而窒息死亡，因此正电荷膜起到物理杀灭或抑制微生物的作用。

产品已由食品药品分析服务有限公司对大量物体表面上鲍曼不动杆菌的杀菌功效做出检测（批准号：9083481，美国）。洁悠神已通过了所有在地面、金属柄表面、有机玻璃表面、塑料柄表面、钢表面的检测。同时，洁悠神已由纽布朗斯维克大学（CE 批准号：153038905）对敷料样品的 Zeta 电位和流体动力学尺寸进行检测。洁悠神具有广泛 pH 值上的高 Zeta 电位值，样品在 0.5%水溶液中的流体动力学尺寸为 2.57 纳米。

临床资料

确诊患有口腔鳞状细胞癌的 60 例患者参与了 2004 年 11 月-2006 年 12 月的研究。他们来自南京大学医学院附属口腔医院，男性 48 例，女性 12 例，平均年龄为 46.5 岁，年龄从 32 至 63 岁不等（见表 1）。随机分为两组：洁悠神治疗组 30 例，男性 18 例，女性 12 例，年龄 32～63 岁；对照组 30 例，男性 15 例，女性 15 例，年龄 33～58 岁。所有患者均签署了知情同意书。该项研究方案是由南京科学项目组伦理委员会董事会所批准的（筹资号：200504019）。

病例纳入和排除标准

被选择接受治疗的患者均患有原发口腔癌瘤，之前未进行任何治疗（如化疗、生物治疗和放疗）。这些接受研究的患者满足以下条件：1）完整患者病历；2）无全身疾病；3）未接受任何其它治疗或未以其它方式治疗。

治疗方法

口腔手术后均预防性应用 500 毫克的口服阿莫西林（每日四次）和 600 毫克的口服克林霉素（每日三次）（马丁等人，2005）。洁悠神治疗组：口腔术后，在口腔、口咽、鼻腔及颈部喷涂洁悠神长效抗菌敷料（30ml/瓶），剂量为 0.1ml/次，每日 3 次，直到术创愈合。对照组：术创采用常规的医疗护理方法和常规清创方法(0.9%氯化钠棉球擦拭术创，

每日 3 次)。

创面外观和愈合的评价标准

术后，观察创面愈合外观。衡量标准包括红肿、疼痛、继发性出血、炎症分泌物的程度，采用行为等级测定法：不同等级表明不同情况。0 分：无明显异常；1～3 分，少许异常；4～5 分，明显异常。

记录创面愈合天数和愈合状况。愈合时间用天数表示，愈合状况用三级系统表示。甲级愈合状况表示：愈合优良，无不良反应，如：疼痛（0-3 级），缝合处肿胀，发炎。乙级愈合状况表示：愈合欠佳，有如下反应，疼痛（4-6 级），缝合处外部肿胀，发炎。丙级愈合状况表示：疼痛（7-10 级），肿胀伴有脓液，创口发炎。

验血、肝肾功能测试

分别在术前、术后一天、术后三天进行全血象验血（Sysmex, KN-21,日本）和肝肾功能测试（COBAS,INEGRA400+,罗氏制药，德国）。

标本采集及细菌培养

在第 2 天用无菌棉签在皮肤、黏膜处采集细菌。浸湿后，立即将棉签放入密闭无菌试管内。厌氧菌培养标本的采集：用注射器吸取术创深部的渗出液，立即放入厌氧标本收集瓶中培养。

表 1.受试者特征

参数	患者数量及参考值(n=60)
年龄	46.5 (年龄范围: 32-63)
性别	48 男 12 女
肿瘤部位	40% 在舌部 60%在口底
癌症类型	鳞状细胞癌
T1-T2 N_0,M_0	60
一级手术切除 ≦2mm	60

T，肿瘤；N，节点；M，转移

表 2. 肿瘤切除后使用洁悠神和使用常规方法的愈合等级对照表

愈合等级	治疗组(n=30)	对照组（n
甲级愈合	26*	22
乙级愈合	4*	8
丙级愈合	0	0

*表明两组间统计差异显著（p<0.05）

表 3. 肿瘤切除后使用洁悠神和使用常规方法伤口愈合时间对照表

	治疗组 (n=30)	对照组 (n=30)
平均术创愈合时间	*8.97±1.22 天	9.74±1.32 天

*表明两组间统计差异显著（p<0.05）

统计学分析

采用（美国 SPSS 软件公司的）SPSS15.0 统计学软件方法分析，在 p<0.05 的水平上的任何差异都在统计学上视作明显。对照、治疗组的症状及愈合的分级评价采用卡方检验进行分析，以获取统计显著性。两组患者样本所有参数的比较采用独立的 t 检验。

结果

创面外观

两组患者共 60 名，均接受口腔功能保全性手术治疗，切除术后体征正常。治疗组手术后 3～5 天内肿胀消退。手术后开始两天，他们的体温范围为 37.8-38.8，轻度发热。

创面愈合

患者均无丙级愈合状况。洁悠神组的甲级、乙级愈合状况的患者数量多于对照组，且有显著差异（p<0.05)。(见表 2)。

创面愈合时间

采用洁悠神的患者的愈合时间要短于采用传统治疗方法的对照组患者。洁悠神组的创面愈合时间为 8.97 天而对照组为 9.74 天（见表 3）。

接受洁悠神物理抗菌敷料治疗的患者和接受传统口服药的患者均未出现任何不良反应。

治疗前后血液、肝肾功能分析

对于血检、肝肾功能检测，接受洁悠神物理抗菌敷料治疗和接受传统口腔护理方法的两组患者在治疗期间和治疗后均无显著差异（p>0.05）(见表 4 和表 5)。

细菌学分析

皮肤或粘膜区均未培养出明显的细菌。从位于切口下方的区域中吸出的 50 个样本则有细菌滋生。创口上最常见的细菌有链球菌属、葡萄球菌属、韦荣球菌属、奈瑟菌属和放线菌属。链球菌属、葡萄球菌属和奈瑟菌属在数量上具有显著的组间差异

（p<0.05）（见表 6）。洁悠神组的链球菌属、葡萄球菌属和奈瑟菌属的数量明显少于使用传统口腔护理方法的对照组。韦荣球菌属和放线菌属在两组间无显著差异（见表 6）。

表 4. 接受洁悠神或常规口腔护理方法（即对照组）治疗的两组在用药前、用药后第一天和用药后第三天白细胞和红细胞的血象.

参数	单位	正常范围	用药前		第 1 天		第 3 天	
			治疗组	对照组	治疗组	对照组	治疗组	对照组
白细胞	x10⁹/L	4.00-11.00	6.2±2.5	5.7±2.8	10.8±1.57	11.9±1.8	7.4±3.2	7.8±4.0
粒细胞	x10⁹/L	0.2-1.30	0.4±0.33	0.4±0.46	0.8±0.26	0.9±0.18	0.6±0.32	0.64±0.41
淋巴细胞	x10⁹/L	1.50-4.00	1.25±0.89	1.0±1.3	1.85±2.0	1.84±2.2	1.86±1.13	1.86±1.3
血红蛋白	g/L	115-165	140±22	138±34	140±27	168±28.9	135±36	190±33
血小板	x10⁹/L	150-400	142±35	122±42	135±41	146±50	125±48	170±152

数据以平均值±95%的置信区间表示。

表 5. 接受洁悠神护理或常规口腔护理方法（即对照组）治疗的两组在用药前、用药后第一天和第三天的肾功能测试表

参数	单位	正常范围	用药前		第 1 天		第 3 天	
			治疗组	对照组	治疗组	对照组	治疗组	对照组
转氨酶 T	U/L	5-31	30±0.5	28±0.23	30±7.0	29.5±7.8	28±10.5	26±3.5
转氨酶/ALT	U/L	12-28	24±1.0	25±0.98	26±0.45	28±0.76	27±0.45	24±1.36
ALB 白蛋白	g/L	42-54	40±3.0	41±3.2	38±4.4	40±5.4	37±6.4	40±5.8
GLB 球蛋白	g/L	20-30	24±3.0	23±3.5	22±4.6	26±5.0	20±6.8	22±7.6

胆红素	Mmol/L	7-19	5.6±1.8	6.1±1.48	8.7±2.4	6.5±2.8	5.6±3.8	4.9±3.5
Cr 肌酐	umol/L	44-106	96±11	97±10	86±13	96±9.5	94±8.8	84±9.6

数据以平均值±95%的置信区间表示（95%CI）。

表 6.　肿瘤切除后手术切口内细菌生长情况

细菌种类	治疗组(n=28)		对照组 (n=22)	
	阳性例数	阳性率	阳性例数	阳性率
链球菌属	8	28.6%	13	59.1%*
葡萄球菌属	9	32.1%	14	63.6%*
韦荣菌属	10	35.7%	10	45.5%
奈瑟菌属	7	25.0%	12	54.5%*
放线菌属	9	32.1%	12	54.5%

* 两组间存在显著差异(p<0.05).

讨论

肿瘤患者很容易受细菌感染。他们免疫力较弱、营养不良、贫血，看起来比之前要更加虚弱。在肿瘤发展过程中，肿瘤细胞本身或由肿瘤细胞产生的水溶性物质灭活淋巴细胞，引起肌体的免疫抑制（Bennett 等人，1996；Camp 等人，1996；Gimmi 等人，1996；Jewett 等人，2006；Mulder 等人，1996）。然而，在肿瘤治疗过程中应用抗肿瘤药物同时也会导致免疫抑制和骨髓抑制。因此，手术部位（Senpuku 等人，2003，2006；Tada 等人，2002a,b）和非手术部位（Angele 和 Faist, 2002；Gotzinger 等人，1996；Tedder 等人，1994；Yehia 等，2004）都有可能发生感染，而且日常生活中任何的小切口都会给肿瘤患者造成致命的感染。口腔癌瘤的手术时间很长，这使得细菌感染的几率又增加了（Angele 和 Faist, 2002; Gotzinger 等人，1996）。因而，有必要采取有效的预防措施来保护患者。

在当今社会，抗菌药物对预防术后感染是非常有帮助的。然而，人们有时却会误用抗菌药物，并滥用抗菌药物。抗菌药物的滥用给人们带来了严重的不良反应，例如过敏反应、毒性反应和机会性感染（Senpuku 等人，2006）。因此，需要为手术病人寻找一种新型的、理想的预防方法来降低细菌感染的机率。

洁悠神物理抗菌敷料是为手术病人新研制发明的治疗方法（南京神奇科技开发有限公司，中国）。它由有机硅季铵盐和高分子活性喷剂水溶性液体构成。这些物质形成正电荷膜，吸附带有负电荷的病原微生物。这些病原微生物因不能进行物质交换而死亡，从而达到物理抗菌的目的。洁悠神物理抗菌敷料不会导致耐药菌的产生，因而是个很好的方法，并且它还提供了有助于预防细菌感染的新方法。

试验结果表明：使用洁悠神物理抗菌敷料不会对病人产生任何严重不良刺激。所有病人术创均顺利愈合，未出现丙级愈合创面。采用洁悠神物理抗菌敷料时，甲级愈合创面和乙级愈合创面的数量增加，创面愈合所需的平均时间与采用常规口腔护理方法的组相比显著缩短 (p<0.05)。分析血液指标和肾肝功能，洁悠神组和采用常规口腔护理方法的组之间并没有显著差异(p>0.05)。这表明洁悠神的使用与采用常规口腔护理的方法一样，不会对人体产生任何显著的副作用。另一方面，洁悠神比常规口腔护理方法(p<0.05)有更好的抑制厌氧菌生长的作用，在常规口腔护理方法中切口下生长的厌氧菌很可能导致伤口感染。

由于口腔颌面部结构十分复杂，且有大量唾液分泌，因而在使用洁悠神物理抗菌敷料时应该采取一些特殊护理。建议在使用洁悠神之前，敷料喷洒应该在清洁伤口后立即均匀喷洒于切口整个表面以便形成正电荷膜并完全覆盖切口表面，从而促进伤口的愈合。如果愈合后缝合的线需要被取出，创面愈合拆线时只需将薄膜轻轻拭去，拆完线后在切口表面再次喷上洁悠神即可。

总的来说，应用洁悠神物理抗菌敷料比常规口腔护理方法效果更佳。洁悠神通过抑制厌氧菌的生长缩短了伤口愈合所需时间，不会产生任何显著的副作用。这种使用简单的预防细菌感染的治疗方法

可以用于那些经过口腔颌面部肿瘤切除手术的病人。

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