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Comparative Analysis of the Effectiveness of Scalp Cooling with PAXMAN Between Dose-Dense AC→PTX and Trastuzumab+Pertuzumab+Docetaxel Regimens in Japanese Breast Cancer Patients.

Shiho Nagasawa1, Koshi Matsui1, Emi Kanaya1, Misato Araki1, Shinichi Sekine1, Mutsuki Furukawa1, Ameri Urasaki1, Tsutomu Fujii1
1Department of Surgery and Science, Faculty of Medicine, Academic Assembly, University of Toyama

Introduction

Chemotherapy-induced alopecia (CIA) remains one of the most distressing side effects of breast cancer treatment, especially for younger patients. Scalp cooling systems such as the PAXMAN Orbis have shown promising results in reducing the incidence and severity of CIA, particularly in regimens involving taxanes and anthracyclines. However, most existing studies focus on single regimens, and comparative evaluations across chemotherapy backbones remain limited.

This study aimed to compare the efficacy of PAXMAN in two commonly used neoadjuvant/adjuvant regimens with differing first-line agents: a dose-dense anthracycline-first regimen (ddAC→ddPTX) and a taxane-based HER2-targeted regimen (trastuzumab + pertuzumab + docetaxel: HP+DTX).

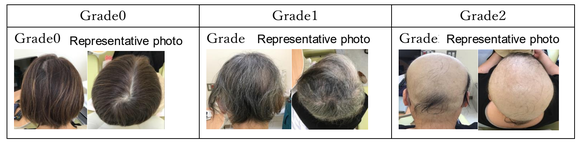
Methods

Standardized scalp photographs were obtained at each chemotherapy session and at 1, 2, and 3 months after completion of treatment.

The degree of alopecia in each photograph was independently evaluated by three reviewers, including breast surgeons.

Alopecia severity at the end of each chemotherapy regimen was assessed using the Common Terminology Criteria for Adverse Events (CTCAE) version 5.0.

Hair preservation was defined as alopecia of Grade 1 or lower.



Patients

This study included 62 patients with early-stage breast cancer who underwent PAXMAN scalp cooling during chemotherapy between January 2021 and December 2024.

The chemotherapy regimens were as follows:

- ✓ a dose-dense anthracycline-first regimen : *n* = 37 (breakdown)
  ddAC 4 cycles→ddPTX 4 cycles: *n* = 37
- ✓ a taxane-based HER2-targeted regimen : *n* = 25 (breakdown)
  HP+DTX 6 cycles: *n* = 18
  HP+DTX 4 cycles→ddAC 4 cycles: *n* = 7

Table 1. Patient characteristics

regimen	ddAC→ddPTX n=37	HP+DTX n=25
Age,year	49.7	51
Breast cancer stage, No.(%)		
Ⅰ	9（24）	9（36）
Ⅱ	24（63）	15（60）
Ⅲ	5（13）	0（0）
Postoperative recurrence	0(0)	1（4）
Type of chemotherapy. No.(%)		
Neoadjuvant	9（20）	18（72）
Adjuvant	28（80）	7（28）

Results

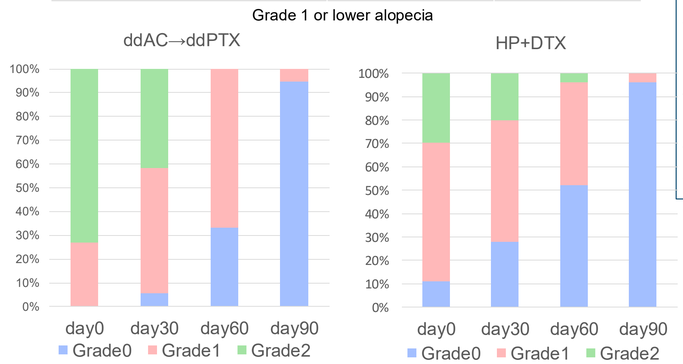
In the ddAC→ddPTX group, 59.5% of patients maintained Grade 1 or lower alopecia at the end of chemotherapy.

In the HP+DTX group, 68% achieved Grade 1 or lower alopecia.

No serious adverse events related to scalp cooling were reported. The treatment adherence and tolerance of the PAXMAN system were high in both groups.

Table 2. Grade 1 or lower alopecia

regimen	ddAC→ddPTX	HP+DTX
end of each chemotherapy regimen	**59.5%**	**68%**
end of chemotherapys (day0)	27%	76%
day30	58%	84%
day60	100%	96%
day90	100%	100%



Discussion

Our study is one of the first to directly compare the effectiveness of scalp cooling between anthracycline-first and taxane-first chemotherapy regimens. Hair preservation success was 59.5% with anthracycline-based regimens and 68% with taxane-based regimens, showing outcomes comparable to or better than previous reports.

Taxane regimens demonstrated slightly higher success, possibly due to lower follicular toxicity compared with anthracyclines.

The overall higher success rate in the taxane group may partly reflect differences in total treatment cycles (some patients received only six cycles).

Even in the small HP + DTX→ddAC cohort (*n* = 7), the success rate was relatively favorable at 57%.

These findings suggest that starting chemotherapy with taxane-based agents may be associated with reduced alopecia, although further study is needed.

Conclusions

To our knowledge, this is the first comparative report from Japan on this topic. The results offer valuable evidence supporting the routine use of scalp cooling in Asian populations, who may differ in hair structure and density from Western cohorts studied previously.

Further prospective, larger-scale studies are warranted to validate these findings and optimize personalized scalp cooling protocols.

Contact

<Shiho Nagasawa>
<Department of Surgery and Science, Faculty of Medicine, Academic Assembly, University of Toyama>
Email:Nagasawa@med.u-Toyama.ac.jp

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