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Evolution of AJCC Staging in Head and Neck Cancer: From the First Edition to Version 9 and Its Implications for Head and Neck cancer treatment – A Narrative Review

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ABSTRACT

Background: The American Joint Committee on Cancer (AJCC) staging system has served as the foundation for prognostication, treatment planning, and outcome reporting in head and neck oncology for nearly five decades. Since its first publication in 1977, the AJCC Cancer Staging Manual has evolved from a predominantly anatomical classification system based on tumor size, nodal involvement, and distant metastasis into a more sophisticated prognostic framework incorporating pathological, biological, and disease-specific factors. These developments have significantly influenced surgical decision-making, particularly in oral cavity squamous cell carcinoma (OCSCC), where factors such as depth of invasion (DOI) and extranodal extension (ENE) now

directly affect stage grouping and therapeutic recommendations. The introduction of separate staging systems for human papillomavirus (HPV)-associated oropharyngeal squamous cell carcinoma (OPSCC), revisions in nasopharyngeal carcinoma classification, and the transition to AJCC Version 9 represent major milestones in the evolution of head and neck cancer staging.

Objective: To review the historical evolution of AJCC staging for head and neck malignancies from the first edition through Version 9 and to evaluate the implications of these changes for oral and maxillofacial surgery practice.

Methods: A narrative review of the literature was performed using landmark AJCC staging manuals, major head and neck oncology publications, consensus recommendations, and contemporary literature discussing AJCC revisions. Particular emphasis was placed on modifications introduced in the seventh, eighth, and ninth editions because of their direct influence on treatment planning and prognostic assessment.

Results: Early AJCC editions focused primarily on anatomical disease extent, whereas later revisions progressively incorporated prognostically significant pathological and biological variables. The eighth edition introduced DOI into T classification for OCSCC, incorporated ENE into nodal staging, established separate staging systems for HPV-associated OPSCC, and refined classifications for nasopharyngeal and cutaneous head and neck malignancies. AJCC Version 9 has further advanced disease-specific staging through updates to HPV-positive OPSCC, salivary gland malignancies, and nasopharyngeal carcinoma.

Conclusion: The AJCC staging system has evolved from an anatomical framework into a biologically informed prognostic model. These changes have significantly improved risk stratification and influenced surgical planning, neck management, reconstructive strategies, and adjuvant treatment decisions. Understanding the evolution of AJCC staging is essential for oral and maxillofacial surgeons involved in contemporary head and neck cancer care.

Keywords: AJCC; TNM staging; Oral cavity squamous cell carcinoma; Head and neck cancer; Depth of invasion; Extranodal extension; HPV-associated oropharyngeal carcinoma; Oral and maxillofacial surgery

INTRODUCTION

Head and neck cancer encompasses a heterogeneous group of malignancies arising from the oral cavity, oropharynx, hypopharynx, larynx, nasopharynx, salivary glands, paranasal sinuses, thyroid gland, and cutaneous structures of the head and neck region. Despite advances in surgical oncology, radiotherapy, systemic therapy,

and molecular diagnostics, accurate staging remains the cornerstone of effective cancer management. Staging systems provide a standardized framework for describing disease extent, predicting prognosis, facilitating communication among clinicians, guiding treatment selection, and comparing outcomes across institutions and populations.[1] The American Joint Committee on Cancer (AJCC) staging system, first published in 1977, was developed to standardize cancer classification through the Tumor Node Metastasis (TNM) framework. Early editions focused predominantly on anatomical disease burden, classifying tumors according to primary tumor size and extent (T), regional lymph node involvement (N), and distant metastasis (M). Although these parameters remain fundamental to oncologic staging, growing evidence has demonstrated that biological and pathological factors substantially influence tumor behavior and survival outcomes. [2] Historically, patients with identical TNM classifications often exhibited markedly different clinical outcomes. This discrepancy was particularly evident in head and neck squamous cell carcinoma (HNSCC), where factors such as tumor depth, extracapsular nodal spread, perineural invasion, viral oncogenesis, and molecular alterations significantly affected prognosis independent of anatomical extent. Consequently, successive AJCC editions sought to refine staging systems by incorporating emerging prognostic variables and disease-specific characteristics. [3] For oral and maxillofacial surgeons, these modifications have had profound implications. Staging systems directly influence decisions regarding primary tumor resection, elective neck dissection, reconstructive requirements, adjuvant therapy, and postoperative surveillance. Modern staging classifications increasingly reflect not only anatomical disease extent but also the biological behavior of tumors, thereby enhancing prognostic accuracy and supporting individualized treatment planning. [4] Among all revisions introduced over the past five decades, the eighth edition of the AJCC Cancer Staging Manual represented the most significant transformation in head and neck oncology. The incorporation of depth of invasion (DOI) into oral cavity cancer staging, extranodal extension (ENE) into nodal classification, and the establishment of separate staging systems for HPV-associated oropharyngeal carcinoma fundamentally altered the prognostic landscape of head and neck cancer. [5] The subsequent introduction of AJCC Version 9 has further accelerated the transition toward disease-specific, evidence-based staging systems that can be updated dynamically as new data emerge. The purpose of this narrative review is to examine the evolution of AJCC staging from the first edition through Version 9, with particular emphasis on the implications of these changes for oral and maxillofacial surgery. By tracing the historical development of staging principles and analyzing their impact on contemporary clinical practice, this review aims to provide surgeons with a comprehensive understanding of the role of AJCC staging in modern head and neck oncology.

MATERIALS AND METHODS

Review Design

This narrative review was conducted to evaluate the chronological evolution of the American Joint Committee on Cancer (AJCC) staging system in head and neck oncology from the first edition published in 1977 through the contemporary AJCC Version 9 updates. Particular emphasis was placed on changes that directly influence oral and maxillofacial surgery (OMFS) practice, including modifications affecting primary tumor staging, regional lymph node classification, pathological reporting, treatment planning, reconstructive surgery, and prognostic assessment. Unlike systematic reviews designed to answer a focused clinical question, the present review aimed to provide a comprehensive historical and clinical overview of staging evolution. Consequently, a narrative review methodology was considered most appropriate.

Literature Search Strategy

Electronic searches were performed using the following databases:

- PubMed/MEDLINE
- Scopus
- Web of Science
- Google Scholar

The search strategy incorporated combinations of the following keywords:

- “AJCC staging”
- “AJCC head and neck cancer”
- “TNM classification”
- “oral cavity squamous cell carcinoma”
- “depth of invasion”
- “extranodal extension”
- “HPV-positive oropharyngeal carcinoma”
- “nasopharyngeal carcinoma staging”
- “salivary gland cancer staging”
- “AJCC eighth edition”
- “AJCC Version 9”

Reference lists of relevant articles were manually reviewed to identify additional studies and historical publications.

Eligibility Criteria

The following publications were considered eligible:

Inclusion Criteria

- AJCC Cancer Staging Manuals
- Original publications describing AJCC revisions
- Head and neck oncology staging reviews
- Consensus recommendations
- Validation studies evaluating staging modifications
- Publications addressing prognostic implications of AJCC revisions

Exclusion Criteria

- Non-English publications
- Conference abstracts without full text
- Studies unrelated to head and neck cancer staging
- Duplicate publications

Data Extraction

Data were extracted regarding:

- Edition-specific staging modifications
- Changes in T classification
- Changes in N classification
- Introduction of pathological prognostic factors
- HPV-related staging modifications
- Salivary gland and nasopharyngeal updates
- Surgical implications of staging revisions

Particular attention was paid to landmark modifications introduced in AJCC 8th Edition and AJCC Version 9 because of their substantial influence on contemporary head and neck cancer management.

Historical Evolution of AJCC Staging: First Through Sixth Editions

(Origins of Cancer Staging)

Prior to the development of formal TNM classification systems, cancer descriptions varied considerably among institutions and countries. Differences in terminology and reporting standards limited meaningful comparison of treatment outcomes and hindered collaborative research efforts.

The concept of TNM staging originated through the work of Pierre Denoix in the 1940s and 1950s, who proposed a structured classification based on primary tumor extent, regional nodal involvement, and distant metastasis. The Union for International Cancer Control (UICC) subsequently adopted and refined these principles, ultimately leading to the development of the AJCC Cancer Staging Manual in North America.[1]

The primary objective of staging was to provide:

- Standardized disease classification
- Prognostic stratification
- Treatment guidance
- Uniform outcome reporting

These principles remain fundamental to modern cancer staging.

AJCC First Edition (1977)

The first AJCC Cancer Staging Manual was published in 1977 and represented a landmark achievement in oncologic standardization. [2]

For head and neck malignancies, staging was largely based on anatomical parameters:

Tumor (T)

Assessment focused on:

- Maximum tumor dimensions
- Local extension
- Involvement of adjacent structures

Nodes (N)

Nodal classification was based on:

- Presence or absence of nodal disease
- Nodal size
- Regional distribution

Metastasis (M)

Classification was straightforward:

- M0: No distant metastasis
- M1: Distant metastasis present

The first edition emphasized reproducibility and simplicity rather than biological complexity.

Impact on Treatment

For oral cavity malignancies, treatment decisions were primarily determined by:

- Tumor size
- Clinical nodal status
- Resectability

Surgery constituted the principal treatment modality, often involving:

- Wide local excision
- Radical neck dissection
- Postoperative radiotherapy for advanced disease

Although primitive by contemporary standards, the first edition established the foundation upon which all subsequent staging systems were built.

AJCC Second Edition (1983)

The second edition focused primarily on refining anatomical definitions and improving consistency between institutions.[3]

Important developments included:

- Improved descriptions of anatomical subsites
- Clarification of tumor extension criteria
- Refinement of nodal categories

The second edition sought to reduce variability in staging assignment and improve interobserver reliability.

Clinical Relevance

For surgeons, improved anatomical definitions facilitated:

- More accurate surgical planning
- Better communication among specialties
- More meaningful outcome comparisons

However, staging remained entirely anatomy-based.

AJCC Third Edition (1988)

By the late 1980s, advances in diagnostic imaging and pathology had highlighted limitations of earlier staging systems. The third edition introduced further refinements including:

- Greater subsite specificity
- Improved nodal classification
- Better definitions of local invasion

These changes reflected increasing recognition that different head and neck subsites exhibit distinct biological behaviors.

Impact on OMFS Practice

For oral and maxillofacial surgeons, the third edition improved assessment of:

- Mandibular invasion
- Floor of mouth involvement
- Tongue tumors
- Cervical lymph node disease

The increasing availability of computed tomography (CT) enhanced preoperative staging accuracy.

AJCC Fourth Edition (1992)

The fourth edition represented another step toward site-specific staging.

Major developments included:

Improved Nodal Classification

Greater emphasis was placed on:

- Nodal size
- Ipsilateral versus contralateral disease
- Bilateral nodal involvement

Enhanced Site-Specific Criteria

Separate considerations were developed for:

- Oral cavity cancers
- Oropharyngeal tumors
- Laryngeal carcinomas
- Hypopharyngeal malignancies

Surgical Implications

The fourth edition improved identification of patients likely to benefit from:

- Elective neck dissection
- Bilateral cervical management
- Adjuvant radiotherapy

These refinements contributed to increasingly individualized treatment planning.

AJCC Fifth Edition (1997)

The fifth edition emerged during a period of rapid advancement in head and neck oncology.

Important developments included:

Standardization of Pathological Staging

Greater emphasis was placed on:

- Histopathological assessment
- Margin evaluation
- Accurate nodal examination

Improved Clinical–Pathological Correlation

The distinction between clinical and pathological staging became increasingly important.

OMFS Perspective

The fifth edition coincided with:

- Expansion of microvascular reconstructive surgery
- Greater use of composite resections
- Increased multidisciplinary management

Consequently, staging began to influence reconstructive planning more directly than in previous decades.

AJCC Sixth Edition (2002)

The sixth edition reflected substantial advances in imaging, pathology, and multidisciplinary oncology.[4]

Integration of Modern Imaging

By the early 2000s:

- CT had become routine.
- MRI provided superior soft-tissue assessment.
- PET imaging was emerging.

These developments improved staging accuracy and facilitated more precise evaluation of local and regional disease. Refinement of T Categories

Tumor classification increasingly reflected:

- Deep tissue invasion
- Involvement of adjacent structures
- Functional consequences of disease

Improved Nodal Assessment

The sixth edition further refined nodal classification according to:

- Size
- Number
- Laterality

Significance for Oral and Maxillofacial Surgeons

The sixth edition improved:

- Selection of surgical candidates
- Determination of resectability
- Reconstruction planning
- Identification of patients requiring multimodal therapy

Nevertheless, staging remained fundamentally anatomical. Important prognostic variables such as depth of invasion, extranodal extension, and HPV status were still absent.

Transition Toward Biological Staging

Despite continuous refinement between the first and sixth editions, significant limitations persisted. Numerous studies demonstrated that patients with identical TNM classifications often experienced markedly different outcomes. These discrepancies suggested that anatomical extent alone could not adequately capture tumor aggressiveness.

Three factors would ultimately transform head and neck cancer staging:

1. Depth of invasion (DOI)
2. Extranodal extension (ENE)
3. Human papillomavirus (HPV) status

Recognition of the prognostic significance of these variables laid the foundation for the revolutionary changes introduced in the seventh and eighth editions of the AJCC Cancer Staging Manual.

AJCC Seventh Edition (2010): The Last Predominantly Anatomical Staging System

The publication of the seventh edition of the AJCC Cancer Staging Manual in 2010 represented the culmination of more than three decades of progressive refinement of anatomical TNM staging. Although the seventh edition incorporated numerous site-specific modifications and reflected advances in imaging and pathology, it remained fundamentally an anatomical classification system. [1] For head and neck cancers, the seventh edition provided detailed staging criteria for the oral cavity, oropharynx, hypopharynx, larynx, nasopharynx, paranasal sinuses, salivary glands, thyroid gland, and mucosal melanoma. The staging framework was based primarily on tumor dimensions, extent of local invasion, nodal disease burden, and distant metastasis. While these parameters provided a practical and reproducible method for disease classification, increasing evidence demonstrated that anatomical staging alone could not adequately account for differences in tumor biology and treatment response. [2]. One of the major limitations of AJCC 7 was the absence of depth of invasion (DOI) in oral cavity squamous cell carcinoma (OCSCC). Multiple studies had already shown that DOI is a strong predictor of occult cervical lymph node metastasis and disease-specific survival. Small but deeply invasive tumors often exhibited more aggressive behavior than larger superficial lesions, yet both could receive identical T classifications under the seventh edition.[3] Similarly, extranodal extension (ENE), previously referred to as extracapsular spread, was recognized as one of the strongest adverse prognostic indicators in head and neck squamous cell carcinoma. Despite its established association with poorer survival and increased recurrence, ENE was not incorporated into nodal staging in AJCC 7.[4] Perhaps the most significant deficiency became evident in oropharyngeal squamous cell carcinoma (OPSCC). During the early 2000s, human papillomavirus (HPV)-associated OPSCC emerged as a distinct biological entity characterized by younger patient age, limited smoking exposure, improved response to treatment, and superior survival outcomes. Despite these differences, AJCC 7 staged HPV-positive and HPV-negative tumors identically, resulting in substantial overestimation of disease severity in HPV-associated cancers. [5] Consequently, although AJCC 7 provided a robust anatomical framework, growing evidence highlighted the need for a staging system capable of incorporating biological and prognostic variables. These concerns ultimately led to the transformative changes introduced in the eighth edition.

AJCC Eighth Edition (2017): A Paradigm Shift in Head and Neck Cancer Staging. The eighth edition of the AJCC Cancer Staging Manual, published in 2017 and implemented in 2018, represented the most significant

revision in the history of head and neck cancer staging. Unlike previous editions, which focused primarily on anatomical disease extent, AJCC 8 incorporated biologically relevant prognostic factors and disease-specific staging systems. [6-8]

The principal objectives of these modifications were:

- Improved prognostic discrimination.
- Better correlation between stage and survival.
- More accurate risk stratification.
- Facilitation of personalized treatment planning.

The most influential changes affected oral cavity cancer, nodal staging, HPV-associated oropharyngeal carcinoma, nasopharyngeal carcinoma, thyroid cancer, and cutaneous squamous cell carcinoma.

Oral Cavity Squamous Cell Carcinoma: Incorporation of Depth of Invasion

Rationale

Depth of invasion emerged as one of the strongest predictors of cervical lymph node metastasis and overall survival in oral cavity cancer. Numerous studies demonstrated that increasing DOI correlates directly with:

- Occult nodal metastasis.
- Local recurrence.
- Disease-specific mortality.
- Reduced overall survival.[9]

Despite this evidence, DOI was not considered in AJCC 7.

AJCC 8TH Classification Changes

Under AJCC 8:

T1

- Tumor ≤2 cm
- DOI ≤5 mm

T2

- Tumor ≤2 cm with DOI >5 mm but ≤10 mm

OR

- Tumor >2 cm but ≤4 cm with DOI ≤10 mm

T3

- Tumor >4 cm

OR

- DOI >10 mm

This represented the first major incorporation of a pathological biological factor into oral cavity cancer staging.[7]

Implications for Oral and Maxillofacial Surgery

-The inclusion of DOI has profoundly influenced surgical practice.

-Elective Neck Dissection

-DOI now serves as a critical determinant of cervical management. Multiple studies have shown that the risk of occult nodal metastasis increases substantially when DOI exceeds 4–5 mm. Consequently, elective neck dissection is frequently recommended even for clinically node-negative tumors with significant DOI. [10]

Surgical Margins

Deeply invasive tumors often require:

- Wider deep margins.
- More extensive soft tissue resection.
- Increased consideration of segmental mandibular resection.

Reconstruction

Higher-stage tumors resulting from DOI upstaging frequently require:

- Radial forearm free flap reconstruction.
- Anterolateral thigh flap reconstruction.
- Fibula free flap reconstruction.

Thus, DOI has become an essential parameter influencing both ablative and reconstructive surgery.

Incorporation of Extranodal Extension Into Nodal Staging

Definition

Extranodal extension refers to the extension of metastatic tumor beyond the lymph node capsule into surrounding soft tissues. ENE has long been recognized as a marker of aggressive tumor biology and poor prognosis. Multiple studies demonstrated associations with:

- Increased locoregional recurrence.

- Reduced disease-free survival.
- Increased distant metastasis.
- Reduced overall survival.[11]

AJCC 8 Changes

For HPV-negative head and neck cancers, ENE was incorporated into pathological nodal staging.

Examples include:

pN3b: Metastatic lymph node with clinically or pathologically evident ENE.

Clinical Significance

The incorporation of ENE improved prognostic stratification and aligned staging more closely with treatment paradigms.

OMFS Implications

Identification of ENE frequently alters postoperative management by necessitating:

- Adjuvant radiotherapy.
- Concurrent chemoradiotherapy.
- Intensified surveillance.

Consequently, meticulous neck dissection and detailed pathological evaluation have become increasingly important components of multidisciplinary care.

HPV-Associated Oropharyngeal Squamous Cell Carcinoma

Emergence of HPV as a Prognostic Factor

During the early twenty-first century, HPV-positive OPSCC emerged as a distinct clinical entity.

Compared with HPV-negative disease, HPV-associated tumors demonstrate:

- Improved treatment response.
- Higher locoregional control rates.
- Significantly better survival outcomes.[12]

Patients with extensive nodal disease often exhibited survival rates comparable to patients with early-stage HPV-negative disease. AJCC 8 introduced an entirely separate staging system for p16-positive OPSCC.

This resulted in:

- Significant downstaging of many tumors.
- Improved correlation between stage and survival.

- Better prognostic accuracy.

Surgical Relevance

Although treatment recommendations remained largely unchanged initially, the new staging system facilitated:

- More accurate patient counselling.
- Improved clinical trial design.
- Development of treatment de-escalation strategies.

For surgeons, HPV status became an essential component of preoperative assessment.

Nasopharyngeal Carcinoma

Nasopharyngeal carcinoma staging was revised to reflect modern MRI-based imaging and contemporary treatment outcomes.

Major revisions included:

- Improved assessment of parapharyngeal extension.
- Refinement of skull base involvement criteria.
- Modification of nodal classification.

These changes enhanced prognostic discrimination and international consistency.[6]

Cutaneous Squamous Cell Carcinoma of the Head and Neck

AJCC 8 introduced a dedicated staging chapter for cutaneous squamous cell carcinoma of the head and neck.

The revision recognized the unique biological behavior of:

- Scalp carcinomas.
- Auricular tumors.
- Facial cutaneous SCC.

This was particularly relevant for maxillofacial surgeons involved in complex craniofacial reconstruction.

Thyroid Cancer

Important modifications were introduced for differentiated thyroid carcinoma.

Major Changes

- Age cutoff increased from 45 to 55 years.
- Reduced emphasis on microscopic extrathyroidal extension.

- Downstaging of many patients.

These revisions significantly improved survival prediction and reduced overstaging.

Salivary Gland Malignancies

Although salivary gland staging remained primarily anatomical in AJCC 8, increasing evidence highlighted the importance of:

- Histological subtype.
- Perineural invasion.
- Molecular alterations.

These observations later influenced Version 9 updates.

Summary of AJCC 8 Changes Relevant to OMFS

Change	Clinical Impact
Depth of invasion	Better prediction of nodal metastasis
Extranodal extension	Improved prognostic stratification
HPV-specific staging	More accurate OPSCC survival prediction
Revised NPC staging	Better MRI-based classification
Cutaneous SCC chapter	Improved facial skin cancer staging
Thyroid revisions	Reduced overstaging
Salivary gland refinement	Foundation for future Version 9 updates

AJCC Version 9: The Era of Dynamic, Disease-Specific Staging

Historically, AJCC revisions occurred approximately every 6–8 years through publication of a complete staging manual. However, rapid advances in cancer biology, molecular diagnostics, and treatment outcomes created challenges for this model. By the time a new edition was published, portions of the staging system could already be outdated. To address this limitation, the AJCC introduced Version 9, a modular framework allowing disease-site-specific updates as evidence emerges rather than waiting for publication of a completely revised manual.

This approach enables continuous refinement of staging systems while preserving consistency in clinical practice.[1] The first major Version 9 updates in head and neck oncology involve:

- HPV-associated oropharyngeal squamous cell carcinoma (OPSCC)
- Salivary gland malignancies
- Nasopharyngeal carcinoma

These updates became effective beginning in 2025–2026 and represent the first phase of a broader transition toward continuously evolving staging systems.[1]

HPV-Associated Oropharyngeal Squamous Cell Carcinoma

Background

AJCC 8 recognized HPV-positive OPSCC as a biologically distinct disease. Although this represented a major advancement, subsequent validation studies revealed opportunities for further refinement.

Large international datasets demonstrated that survival outcomes within AJCC 8 stage groups remained heterogeneous. Consequently, Version 9 introduced modifications designed to improve prognostic discrimination and better reflect contemporary treatment outcomes.[2]

Clinical Implications

The continued refinement of HPV-positive OPSCC staging reflects several important developments:

- Increasing prevalence of HPV-associated disease worldwide.
- Improved survival rates resulting from modern treatment approaches.
- Growing interest in treatment de-escalation protocols.

For oral and maxillofacial surgeons, accurate staging remains essential for multidisciplinary treatment planning and patient counseling.

Salivary Gland Malignancies

Rationale for Revision

Salivary gland cancers represent a highly heterogeneous group of neoplasms comprising more than twenty distinct histopathological subtypes. Traditional staging systems relied primarily on anatomical disease extent despite substantial biological differences among tumor types. Recent advances in molecular pathology have identified prognostically significant genetic alterations in several salivary gland malignancies, including:

- Secretory carcinoma

- Salivary duct carcinoma
- Adenoid cystic carcinoma
- Mucoepidermoid carcinoma

Version 9 incorporates contemporary evidence regarding disease behavior and prognostic stratification. [3]

Surgical Relevance

For OMFS surgeons, these changes may influence:

- Extent of resection
- Facial nerve management
- Neck dissection decisions
- Reconstruction planning
- Adjuvant treatment recommendations

Future AJCC updates are expected to incorporate additional molecular biomarkers as evidence continues to accumulate.

Nasopharyngeal Carcinoma

Evolution of Nasopharyngeal Staging

Nasopharyngeal carcinoma (NPC) has undergone repeated staging revisions because of major advances in:

- Magnetic resonance imaging
- Intensity-modulated radiotherapy
- Systemic therapy
- International outcome reporting

Version 9 NPC staging was developed using contemporary multinational datasets and reflects modern treatment outcomes more accurately than previous systems.[4]

Major Objectives

The principal goals of Version 9 NPC staging include:

- Improved prognostic discrimination.
- Better survival prediction.
- Simplification of stage categories.
- Enhanced international applicability.

Clinical Implications

Although surgery plays a limited role in NPC management, accurate staging remains critical for:

- Treatment planning.
- Risk stratification.
- Clinical trial design.
- Outcome comparison.

Impact of AJCC Evolution on Oral and Maxillofacial Surgery

The evolution of AJCC staging has fundamentally altered the role of oral and maxillofacial surgeons in head and neck oncology.

Historically, surgical decisions were guided primarily by anatomical disease extent. Contemporary staging systems now incorporate biological and pathological variables that directly influence treatment selection and prognosis.

Primary Tumor Resection

The incorporation of DOI into oral cavity cancer staging has significantly affected surgical planning.

Contemporary Considerations

Modern surgical decision-making includes:

- Surface dimensions
- Depth of invasion
- Bone involvement
- Soft tissue infiltration
- Functional considerations

Consequently, surgeons increasingly rely on cross-sectional imaging and detailed pathological evaluation when planning resections.

Neck Management

One of the most important consequences of AJCC evolution is improved risk prediction for cervical metastasis.

Elective Neck Dissection

The introduction of DOI has strengthened indications for elective neck dissection in clinically node-negative disease.

Patients with:

- DOI >4 mm
- DOI >5 mm

are now recognized as having substantially higher risks of occult nodal metastasis.[5]

Therapeutic Neck Dissection

The incorporation of ENE into nodal staging has improved identification of patients requiring:

- More aggressive neck management.
- Adjuvant chemoradiotherapy.
- Enhanced surveillance.

Reconstruction

Stage migration resulting from DOI and ENE incorporation has increased the number of patients classified as advanced-stage disease.

Consequently, reconstructive surgery plays an increasingly important role.

Common reconstructive options include:

Soft Tissue Reconstruction

- Radial forearm free flap
- Anterolateral thigh flap
- Pectoralis major myocutaneous flap

Osseous Reconstruction

- Free fibula flap
- Scapular free flap
- Iliac crest free flap

The relationship between staging and reconstruction continues to strengthen as surgical oncology becomes increasingly personalized.

Pathology Reporting

Modern AJCC staging depends heavily on accurate pathological assessment.

Current pathology reports should routinely include:

- Depth of invasion
- Margin status
- Perineural invasion
- Lymphovascular invasion

- Extranodal extension
- Number of metastatic lymph nodes

These variables have become integral components of multidisciplinary decision-making.

Adjuvant Therapy

The incorporation of prognostic variables into staging has improved selection of patients requiring postoperative therapy.

Radiotherapy

Recommended for:

- Advanced T stage disease
- Multiple nodal metastases
- Perineural invasion

Concurrent Chemoradiotherapy

Frequently indicated when:

- ENE is present
- Positive margins exist
- High-risk pathological features are identified

Consequently, AJCC staging now directly influences treatment intensity.

Future Directions

The AJCC staging system continues to evolve toward precision oncology.

Future revisions are likely to incorporate:

Molecular Biomarkers

Examples include:

- TP53 alterations
- NOTCH pathway abnormalities
- PIK3CA mutations
- EGFR signaling abnormalities

Genomic Profiling

Genomic risk stratification may improve prediction of:

- Recurrence
- Metastasis
- Treatment response

Artificial Intelligence

Machine-learning algorithms may eventually integrate:

- Imaging data
- Histopathology
- Genomics
- Clinical variables

to generate individualized prognostic models.

Radiomics

Advanced imaging analysis may permit non-invasive prediction of:

- Tumor aggressiveness
- Nodal metastasis
- Treatment response

Liquid Biopsy

Emerging biomarkers such as:

- Circulating tumor DNA
- HPV DNA
- Epstein-Barr virus DNA

may become future staging components.

CONCLUSION

The AJCC staging system has undergone remarkable transformation since the publication of its first edition in 1977. Early editions focused almost exclusively on anatomical disease extent, providing a standardized framework for cancer classification and outcome reporting. Progressive refinements improved staging accuracy; however, significant limitations remained because anatomical parameters alone could not adequately capture tumor biology and prognosis. The eighth edition represented the most important milestone in the evolution of head and neck cancer staging. The incorporation of depth of invasion into oral cavity squamous cell carcinoma staging, extranodal extension into nodal classification, and separate staging systems for HPV-associated oropharyngeal carcinoma significantly improved prognostic stratification and clinical relevance. These changes have directly influenced surgical planning, elective neck dissection decisions, reconstruction strategies, pathological reporting, and adjuvant treatment recommendations. AJCC Version 9 continues this transition toward disease-specific, evidence-based staging through ongoing updates for HPV-associated OPSCC, salivary gland malignancies, and nasopharyngeal carcinoma. The shift from periodic manual revisions to dynamic modular updates reflects the increasing pace of advances in oncology. For oral and maxillofacial surgeons, understanding the evolution of AJCC staging is essential for contemporary head and neck cancer management. Future staging systems will likely incorporate molecular biomarkers, genomic profiling, artificial intelligence, radiomics, and liquid biopsy technologies, further advancing the goal of personalized oncologic care.

Table 1. Timeline of AJCC Evolution in Head and Neck Cancer

Edition Year Major Contribution

Rank	Year	Description
1st	1977	Initial TNM framework
2nd	1983	Anatomical refinements
3rd	1988	Site-specific improvements
4th	1992	Enhanced nodal classification
5th	1997	Improved pathological staging
6th	2002	Imaging integration
7th	2010	Final predominantly anatomical system

Rank	Year	Description
8th	2017	DOI, ENE, HPV-specific staging
9th	2025–2026	Disease-specific dynamic updates

Table 2. AJCC 7th Versus AJCC 8th Edition Oral Cavity Staging

Parameter	AJCC 7	AJCC 8
DOI	Not included	Included
ENE	Not included	Included in nodal staging
HPV staging	Not applicable	Separate OPSCC staging
Prognostic accuracy	Moderate	Improved
Treatment guidance	Anatomical	Anatomical + biological

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