

The Smile the Signal Can't Reach: AI Remote Monitoring, Clear Aligner Therapy, and the Medicaid Gap in American Indian and Alaska Native Communities

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Abstract: Clear aligner therapy has evolved into a digitally native orthodontic modality whose principal clinical advantages — removability, periodontal comfort, and, increasingly, artificial-intelligence-assisted remote monitoring — depend on infrastructure and insurance conditions that are unevenly distributed across the United States. This narrative review examines an intersection that has received little attention in the orthodontic literature: the potential of clear aligner teleorthodontics to reduce the extraordinary travel burden faced by American Indian and Alaska Native (AI/AN) patients served by the Indian Health Service (IHS) and tribal dental programs, set against two compounding barriers — persistent broadband deserts on tribal lands and a Medicaid orthodontic benefit structure that, through state-specific Handicapping Labio-Lingual Deviation (HLD) indices and “least-costly-alternative” coverage doctrines, routinely excludes clear aligners even when a fixed-appliance alternative is clinically inferior for a given patient. The review synthesizes evidence on AI/AN oral health disparities, tribal broadband deployment statistics, and the fifty-state patchwork of Medicaid orthodontic eligibility criteria, situating clear aligner materials, biomechanics, and AI-based monitoring literature within this policy context. The findings indicate that the very feature that makes clear aligners attractive for geographically isolated populations — reduced reliance on in-person visits — is undermined by the same populations' disproportionate lack of the connectivity such monitoring requires, while Medicaid's near-categorical classification of aligners as cosmetic forecloses the benefit before the connectivity question is ever reached. The

review concludes with a National Interest and Significance section outlining policy levers — Universal Service Fund/BEAD broadband build-out, HLD modernization, and IHS-Medicaid care coordination — capable of closing both gaps concurrently.

Key Word: *Clear Aligners; Teleorthodontics; American Indian and Alaska Native Health; Medicaid; Indian Health Service; Digital Divide; Orthodontic Coverage.*

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I. Introduction

Clear aligner therapy (CAT) has been reframed by the recent orthodontic literature as an inherently digital, computer-aided-design/computer-aided-manufacturing (CAD/CAM) workflow in which artificial intelligence increasingly participates at every stage — diagnosis, movement prediction, attachment design, and, notably, remote monitoring of treatment progress^{1,2}. Platforms such as smartphone-based intraoral scanning paired with deep-learning “GO/NO-GO” algorithms are explicitly designed to reduce the number of in-person visits a patient must make over the course of treatment². For most American orthodontic patients, this is a matter of convenience. For a defined subset of the population, it could be a matter of feasibility altogether.

American Indian and Alaska Native (AI/AN) communities occupy a uniquely disadvantaged position in the American oral health landscape. Roughly half of AI/AN people live in federally designated Dental Provider Shortage Areas, and the dentist-to-population ratio in many AI/AN service areas is less than half the national average^{3,4}. In rural Alaska, tens of thousands of Alaska Native people live in villages unconnected to the road system, requiring travel by air or water to reach a dental clinic⁵. These same populations are disproportionately covered by Medicaid, whose orthodontic benefit for children under twenty-one is a federal entitlement under Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) rules, but whose actual scope — which appliance is authorized, which malocclusions qualify, and which index is used to decide — is set independently by each state⁶.

This review asks a question that, to the authors' knowledge, has not been posed directly in the clear aligner literature: what happens when a technology whose central selling point is reduced travel is deployed into a population defined by both extreme travel burden and extreme connectivity scarcity, under an insurance system that in practice excludes the technology outright? The purpose of this narrative review is threefold: (1) to summarize the AI/AN oral health access literature and the teleorthodontic capabilities of contemporary clear aligner systems; (2) to document the broadband infrastructure gap on tribal lands as a structural limit on any telehealth-dependent solution; and (3) to map the fifty-state variation in Medicaid orthodontic eligibility criteria and its specific, near-categorical exclusion of clear aligners as a covered appliance, with attention to how this exclusion falls hardest on populations who would benefit most from the modality's remote-monitoring advantages.

II. Methodology

This is a narrative review, not a systematic review, and no PRISMA protocol or formal risk-of-bias appraisal was applied. Literature was retrieved through PubMed/MEDLINE and general web-based search of governmental, tribal-health, and legal sources published predominantly between 2005 and 2026, using combinations of the terms “American Indian,” “Alaska Native,” “Indian Health Service,” “dental access,” “broadband,” “tribal lands,” “telehealth,” “Medicaid orthodontic,” “Handicapping Labio-Lingual Deviation,” “clear aligners,” and “teleorthodontics.” Governmental and regulatory sources — Federal Communications Commission (FCC) and Bureau of Indian Affairs (BIA) broadband reports, state Medicaid administrative codes, and IHS data briefs — were included alongside peer-reviewed literature because much of the relevant evidence on coverage rules and infrastructure deployment resides in primary regulatory documents rather than journal articles. Two companion narrative reviews on the materials science, biomechanics, clinical evidence base, and artificial-intelligence applications of clear aligner therapy^{7,2} were used as the technical foundation for the discussion of aligner capabilities and limitations, and are cited throughout rather than re-summarized in full.

III. The Orthodontic and Oral Health Burden in American Indian and Alaska Native Communities

AI/AN adults and children report lower rates of dental visitation than the general U.S. population — 69% of AI/AN adults reported seeing an oral health provider in the past year, compared with 79% of non-AI/AN adults, and AI/AN respondents were also markedly less likely to report having dental insurance or a regular dental home⁸. More than half of surveyed AI/AN adults reported having been denied care, or having experienced discrimination in a care setting, at some point⁸. Dental caries, the most common chronic disease of childhood nationally, is disproportionately concentrated in AI/AN children, compounding the population's downstream need for restorative and, later, orthodontic intervention⁵.

Access barriers are structural rather than attitudinal. The IHS, tribal, and urban Indian dental care delivery system — chronically understaffed even before the COVID-19 pandemic — reported a further decline in adult dental visitation between 2015 and the 2021–2022 survey cycle, attributed in part to pandemic-era service limitations⁹. Approximately half of AI/AN people live in areas the federal government designates as Dental Provider Shortage Areas, and the ratio of dentists to population in many AI/AN service areas remains less than half the national average^{3,4}. Rurality compounds workforce scarcity: a community-based study in Oklahoma found that geographic isolation, not merely income, independently shapes AI/AN residents' ability to obtain oral health care and their attitudes toward alternative delivery models such as dental therapists¹⁰. In rural Alaska specifically, most of the roughly two hundred Alaska Native villages are unconnected to the state road system, so a routine specialty visit — the kind an orthodontic course of treatment requires repeatedly over eighteen to thirty months — can require travel by small aircraft or boat⁵.

No large AI/AN-specific epidemiological dataset on malocclusion prevalence exists in the literature reviewed here, a gap this review does not attempt to fill. What is well established is that the population's downstream orthodontic need is filtered through the same generalist-dentist-to-specialist referral chain that is itself constrained by workforce shortage, meaning that even a patient with a clearly handicapping malocclusion may face a referral bottleneck before insurance coverage or appliance choice becomes a relevant question at all³.

IV. The Teleorthodontic Promise of Clear Aligner Therapy — and What It Requires

Clear aligner therapy is, by design, better suited than fixed appliances to a reduced-visit protocol. Because each aligner in a series encodes a small, pre-planned increment of tooth movement generated from a digital setup, clinicians can — at least in principle — verify progress from patient-submitted smartphone intraoral scans rather than requiring an in-person adjustment appointment². The most extensively studied commercial platform for this purpose, Dental Monitoring®, uses deep-learning image analysis of patient-captured scans to generate automated “GO/NO-GO” instructions indicating whether a patient may advance to the next aligner without an office visit². Scoping and systematic-review evidence identifies forty-five studies published between 2015 and 2025 evaluating AI-based or smartphone-enabled remote monitoring platforms in clear aligner therapy, with publication output accelerating steadily after 2018².

This is, on its face, precisely the kind of intervention that could offset the travel burden documented in Section III: fewer required trips to an orthodontist's office, verified remotely, would disproportionately benefit a patient traveling by boat or driving several hours across a reservation to the nearest specialty clinic. The literature, however, is explicit that this promise is neither unconditional nor risk-free even for well-connected patients. A prospective evaluation of automated GO/NO-GO monitoring found meaningful discrepancies in tooth-position assessment relative to in-office clinical judgment, and the broader AI-in-orthodontics literature places such systems at a relatively low rung of a proposed six-level clinical-autonomy framework, one still requiring active human oversight rather than functioning as an autonomous replacement for periodic in-person evaluation². Clear aligner therapy's biomechanical envelope is also narrower than that of fixed appliances for root torque, rotation of rounded teeth, vertical intrusion and extrusion, and complex extraction cases — precisely the categories of malocclusion most likely to trigger Medicaid's severity-based eligibility thresholds in the first place^{2,7}. In other words, the patients most likely to qualify for a Medicaid-funded orthodontic benefit on severity grounds are, on average, the same patients for whom clear aligner monotherapy is least biomechanically reliable without adjuncts such as temporary anchorage devices or attachments².

Even setting biomechanics aside, the entire teleorthodontic value proposition is conditional on a resource this review's target population disproportionately lacks: reliable broadband connectivity capable of transmitting a usable intraoral scan.

V. The Digital Divide: Broadband Access on Tribal Lands as a Structural Limit on Teleorthodontics

Broadband internet access has been described in the public health law literature as a “super-determinant of health,” shaping the practical reach of telehealth, education, and employment alike, and the authors of that framework specifically flag Native American communities as among the most severely underserved¹¹. Federal Communications Commission (FCC) data document the scale of the gap with some consistency across reporting years: in 2019, only 65% of housing units on rural AI/AN lands had access to broadband service that over 99% of urban U.S. housing units already enjoyed, and only 46.6% of rural AI/AN communities had fixed broadband coverage from any terrestrial provider, compared with 73.3% of rural non-AI/AN areas¹². More recent FCC reporting places the share of Americans on tribal lands lacking broadband meeting the Commission's 100/20 Mbps minimum benchmark at approximately 24% as of 2022, against roughly 28% for rural America generally and a far smaller share in urban areas¹³. An earlier FCC estimate placed the tribal-lands broadband deficit at over 35%, against roughly 30% for rural America and about 2% for urban neighbors¹⁴.

Roughly 1.4 million people living on U.S. tribal lands lack broadband access altogether, a figure the public-health-law literature ties directly to reduced telehealth utilization and, more broadly, to compounding disparities in education, employment, and criminal-justice exposure¹¹. The causes are structural rather than incidental: private providers are reluctant to build towers or lay fiber in low-density tribal territories, historic federal funding allocations to tribes and tribally owned providers have been comparatively small, and the administrative burden of federal broadband grant applications has been repeatedly identified by tribal representatives as a barrier in itself¹¹. Recent federal investment — including the Tribal Broadband Connectivity Program's roughly two-billion-dollar allocation for deployment, telehealth, distance learning, and digital-inclusion initiatives under the 2021 Infrastructure Investment and Jobs Act — is intended to close this gap, but deployment on the rugged, sparsely populated terrain typical of many reservations remains a multi-year undertaking rather than a solved problem^{15,16}.

The clinical implication is direct. A remote-monitoring protocol that depends on a patient uploading a smartphone-captured intraoral scan at regular intervals is not merely inconvenient without broadband — it is functionally unusable. For a subset of AI/AN patients, then, the single feature of clear aligner therapy most plausibly suited to their geographic circumstances is the feature least likely to be technically available to them. This is not a reason to withhold aligners from AI/AN patients who can use them conventionally, in-office; it is a reason not to treat teleorthodontic monitoring as a general solution to this population's access problem without first confirming the connectivity it presupposes.

VI. The Medicaid Orthodontic Coverage Gap: HLD Indices, “Least-Costly-Alternative” Rules, and the Exclusion of Clear Aligners

Federal Medicaid law requires states to cover medically necessary orthodontic treatment for EPSDT-eligible beneficiaries under twenty-one, but leaves each state free to define what counts as “medically necessary” and to select its own severity index for making that determination⁶. The most widely used tool remains some variant of the Handicapping Labio-Lingual Deviation (HLD) index, a scoring system originally developed by Draker¹⁷ for public-health screening purposes and since modified independently by numerous states — Rhode Island, New Jersey, California, and Idaho each maintain their own point-weighted variant, alongside states using entirely different instruments such as the Salzmann Index, the Index of Complexity, Outcome and Need, or purely photographic review⁶. A 2013 comparative analysis found that the choice of index, and even the choice between photographic and study-cast review within the same index, produces materially different eligibility outcomes for the same malocclusion¹⁸.

The practical stakes of this variation are illustrated by Illinois's 2017 transition from a proprietary DentaQuest criteria index to the HLD index: a before-and-after comparison of consecutively approved and denied cases at the University of Illinois at Chicago found a statistically significant decrease in the overall approval rate for Medicaid-funded orthodontic treatment following the switch, with the authors concluding that the index change itself, independent of any change in patient need, had reduced access to care¹⁹. A subsequent methodological study of the same Illinois system found only weak agreement between HLD scores calculated from digital models versus visual inspection, and concluded that Medicaid managed-care organizations appeared to be relying on criteria beyond the documented HLD score itself when approving or denying treatment — a finding the authors characterized as inconsistent with patients' actual documented treatment need²⁰. A national comparison of state Medicaid orthodontic funding rules between 2006 and 2015 similarly found that access barriers had increased over the decade, that reviewer qualifications for eligibility determinations vary from exclusively orthodontists in some states to exclusively non-dentists in others, and that the disproportionate fiscal burden of the 2008 recession and the Affordable Care Act's Medicaid provisions fell hardest on already economically stressed states⁶.

Layered on top of index-based severity screening is a separate and, for the purposes of this review, more consequential rule: most state Medicaid dental programs apply some form of a “least-costly-alternative” (or least-costly-effective-treatment) principle, under which the program will authorize the lowest-cost appliance capable of achieving an acceptable clinical outcome, placing the burden of proof for any costlier alternative on the treating clinician²¹. In practice, clear aligners are treated across the sources reviewed here as a premium, largely elective category rather than a medically equivalent alternative to fixed appliances, meaning that even a patient who clears the HLD or equivalent severity threshold for orthodontic coverage will, in the overwhelming majority of states, be authorized for conventional brackets and wires rather than for clear aligners, regardless of any patient-specific reason — behavioral, medical, or logistical — that clear aligners might be the more clinically appropriate choice^{21,22}. A small number of states carve out orthodontic coverage more broadly, but almost exclusively for a narrow list of craniofacial diagnoses — cleft lip and palate, hemifacial microsomia, Treacher Collins syndrome, and similar conditions — rather than for malocclusion severity or appliance preference in general²². Mississippi, illustratively, caps total Medicaid-funded orthodontic-related benefit at \$4,620 per beneficiary over a lifetime, a

ceiling that in most markets does not accommodate the added laboratory and monitoring-platform costs typically associated with clear aligner systems even where a state does not categorically exclude them²³.

The clinical review literature on clear aligners does not resolve this policy question, but it does complicate the premise that fixed appliances are always the clinically equivalent — let alone superior — “least costly alternative.” For mild-to-moderate Class I malocclusions requiring primarily tipping movements, aligners achieve comparable treatment accuracy to fixed appliances while offering documented periodontal and hygiene advantages, particularly relevant for patients for whom more frequent in-person hygiene reinforcement is itself difficult to arrange². For patients whose behavioral profile, transportation constraints, or oral hygiene circumstances make a removable, more hygienic appliance the more realistic path to a completed course of treatment, a categorical Medicaid exclusion of aligners is not merely a cost-control measure; it may functionally convert a treatable malocclusion into an untreated one, particularly where the alternative is a fixed-appliance course of treatment the patient's transportation and compliance circumstances make difficult to complete at all.

VII. State-by-State Variation and Its Disproportionate Weight in Indian Country

Because Medicaid orthodontic eligibility, appliance authorization, and lifetime benefit caps are all set at the state level, an AI/AN family's access to any orthodontic benefit — let alone a clear aligner option — depends substantially on which state, and in many cases which specific reservation, they live in^{6,18}. This state-line dependency interacts with tribal geography in a way the general Medicaid-variation literature does not typically foreground. Tribal lands and reservations do not respect state boundaries, and a number of federally recognized tribes — the Navajo Nation across Arizona, New Mexico, and Utah, or the several Sioux nations across the Dakotas, Nebraska, and Minnesota, among others — have enrolled members whose Medicaid orthodontic eligibility, appliance options, and reviewer qualifications differ meaningfully depending on which side of an entirely administrative state line a given household resides, despite sharing the same IHS service area, the same tribal dental infrastructure, and often the same extended family⁶. A patient physically closer to an IHS or tribal dental clinic than to any state-line-defined alternative may nonetheless be subject to a stricter HLD variant, a lower lifetime benefit cap, or a narrower list of automatically qualifying conditions purely as a function of which state administers the Medicaid program covering that clinic's catchment area.

This variation compounds rather than offsets the broadband gap described in Section V. A state with a relatively generous orthodontic benefit and even a hypothetical allowance for clear aligners offers little practical advantage to a family in a broadband-dark portion of that same state's tribal land, since the monitoring modality the benefit would nominally allow cannot function without connectivity. Conversely, a state with strong tribal broadband infrastructure investment offers no orthodontic benefit at all if that state's Medicaid program excludes aligners categorically or sets its HLD threshold restrictively. The two gaps identified in this review — infrastructure and insurance — therefore do not operate independently; a family must clear both simultaneously, and the geography of tribal lands means that the two barriers are not even reliably correlated at the state level, since broadband deployment funding decisions and Medicaid dental policy are administered by entirely separate state and federal agencies with no coordination mechanism identified in the sources reviewed here.

VIII. Discussion: A Compounding, Not Additive, Disparity

The evidence assembled here supports a narrower and more specific claim than “AI/AN communities face dental disparities,” a proposition already well documented^{8,3}. The narrower claim is that clear aligner therapy's most-cited access advantage over fixed appliances — reduced dependence on in-person visits through AI-assisted remote monitoring² — is specifically and disproportionately unavailable to a population defined by two independent, compounding constraints: among the least broadband-connected populations in the country^{12,11}, and covered overwhelmingly by a Medicaid benefit structure that treats clear aligners as a non-covered, cosmetic-adjacent option almost everywhere they are covered by Medicaid at all^{21,22}. The two barriers are not merely additive; each independently forecloses the same intervention, so that solving only one — expanding broadband, or reforming Medicaid coverage — would not by itself restore the teleorthodontic pathway this review examines. Both must be addressed for the intervention to become clinically real for this population, rather than theoretically available.

It is also worth stating plainly what this review does not claim. It does not argue that clear aligners are clinically superior to fixed appliances for AI/AN patients as a class; the biomechanical literature is explicit that aligners remain less predictable for root torque, rotation of rounded teeth, vertical movement, and extraction cases, and that even AI-assisted planning narrows rather than eliminates the gap between predicted and achieved tooth movement^{2,7}. Nor does it argue that broadband expansion alone would solve AI/AN oral health disparities, which are rooted at least as much in generalist and specialist workforce shortage as in any single technology gap^{4,3}. The claim is narrower: that a specific, policy-relevant intervention — teleorthodontic clear aligner monitoring — sits at the exact intersection of two well-documented but rarely juxtaposed American structural gaps, and that neither

the orthodontic technology literature nor the Medicaid policy literature reviewed here appears to have examined that intersection directly.

IX. Limitations

This narrative review has several limitations. First, no formal systematic search protocol or risk-of-bias appraisal was applied, and source selection, while broad, is not exhaustive. Second, no AI/AN-specific epidemiological data on malocclusion prevalence, orthodontic treatment-seeking, or clear-aligner utilization were identified in the literature reviewed; the analysis therefore infers this population's likely exposure to the barriers described from adjacent, well-documented data on general oral health access, broadband deployment, and Medicaid orthodontic policy rather than from a study population of AI/AN orthodontic patients directly. Third, Medicaid administrative rules and broadband deployment statistics are both subject to frequent revision; the figures cited here reflect the most recent verifiable sources available at the time of writing and should be reconfirmed against current state Medicaid manuals and FCC reporting before being used for individual case advocacy. Fourth, this review does not address private dental insurance, IHS direct-service dental benefits, or the Children's Health Insurance Program (CHIP) in comparable depth, each of which interacts with Medicaid coverage in ways beyond this review's scope.

X. National Interest and Significance

The issue examined in this review carries significance beyond a single clinical modality or a single population. First, it illustrates a general policy failure mode relevant well beyond orthodontics: digital-health interventions marketed as equity solutions for geographically isolated populations can, without deliberate design, worsen rather than narrow disparities if deployed without regard to the connectivity infrastructure such interventions presuppose — a pattern documented across telehealth more broadly on tribal lands and rural America^{11,16}. Second, federal broadband investment already underway — the Tribal Broadband Connectivity Program and related Infrastructure Investment and Jobs Act allocations — could be explicitly evaluated, and where appropriate prioritized, for its capacity to enable telehealth and teledentistry applications in addition to its stated educational and economic goals, since the marginal cost of enabling a health-specific use case on infrastructure being built for other reasons is typically far lower than building purpose-specific health connectivity from scratch¹⁵. Third, Medicaid HLD modernization — replacing decades-old, inconsistently modified indices with validated, appliance-neutral medical-necessity criteria, and revisiting blanket least-costly-alternative exclusions of clear aligners in favor of case-by-case clinical justification — is a policy change achievable at the state administrative level without new federal legislation, and several of the sources reviewed here^{19,20} already supply the methodological basis for such reform. Fourth, closer coordination between IHS dental programs and state Medicaid dental administrators — most AI/AN Medicaid beneficiaries are simultaneously eligible for IHS or tribal dental services, yet the sources reviewed here identify no formal coordination mechanism between the two systems on orthodontic referral, appliance authorization, or teleorthodontic infrastructure — represents an underused lever for closing both the coverage gap and the infrastructure gap in tandem, given that IHS facilities are themselves federal entities positioned to serve as broadband and telehealth access points for the same population.

XI. Conclusion

Clear aligner therapy's evolution into an AI-assisted, remotely monitored treatment modality has been framed in the recent literature primarily as a matter of convenience and workflow efficiency. For American Indian and Alaska Native communities, whose access to orthodontic care is already constrained by geography, workforce shortage, and disproportionate reliance on Medicaid, the same technology represents something closer to a potential structural solution — one that current broadband infrastructure and Medicaid coverage rules jointly prevent from being realized. Closing this compound gap will require coordinated action across telecommunications policy, state Medicaid administration, and Indian Health Service dental programming; addressing any one domain in isolation is unlikely to make clear aligner teleorthodontics a genuine option for the population this review examines.

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